FLIGHT
The AIRCRAFT ENGINEER & AIRSHIPS

First Aero Weekly in the World

Founder and Editor: STANLEY SPOONER

A Journal devoted to the Interests, Practice, and Progress of Aerial Locomotion and Transport

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"FLIGHT" PHOTOGRAPHS.

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DIARY OF FORTHCOMING EVENTS

Club Secretaries and others desirous of announcing the dates of important fixtures are invited to send particulars for inclusion in the following list:—

1926

Nov. 30 .... **Mr. F. S. Barton, M.A., F.Inst.P. "Air Photography Apparatus," before Inst.Ae.E.**

Dec. 2 .... **Mr. P. B. Henshaw. "Valve Steels," before R.Ae.S.**

Dec. 3-19 .... **Paris Aero Show**

EDITORIAL COMMENT.

GRADUALLY the seaplane is emerging from the obscurity into which it fell during the years immediately following the war, and is winning for itself the place in the scheme of things to which it is entitled. First we have the very long flight from Rome to and around Australia, on to Tokio, and back to Rome, of the famous Italian aviator Marchese de Pinedo. Then Sir Alan Cobham's flight to Australia and back. The two magnificent flights across the South Atlantic by a Fairey seaplane and a Dornier flying-boat, both accomplished with British engines, will, of course, always rank among the outstanding trans-oceanic flights in the history of flying. And now comes the report that a French airman, Lieut. Bernard has successfully covered the distance between Marseilles and Madagascar in a Liore and Olivier flying-boat, fitted with a Gnome-Rhone "Jupiter" engine. In point of actual distance this latest flight does not, it is true, equal some of the other great seaplane flights carried out, but it is a meritorious one nevertheless, because of the fact that it covered districts where the seaplane has not hitherto penetrated, and districts situated in tropical Africa.

The Seaplane Again

Leaving the Etang de Berre, near Marseilles, on October 12, two machines set out for Madagascar, the Liore and Olivier, and a C.A.M.S. The latter sustained a certain amount of damage on the Niger, and has not, so far, been able to proceed, but the LeO got through, and arrived on the coast of Madagascar on November 22, having covered a distance of approximately 8,250 miles. The flight was, no doubt, inspired by Sir Alan Cobham's flight to Australia and back, on the D.H. 50 with Armstrong-Siddeley "Jaguar," and with the object of ascertaining the possibilities of air communication by means of seaplanes in the French colonies, and, like Cobham's great adventure, it is believed to have shown definitely that the seaplane can be of the very greatest service in out of the way localities.

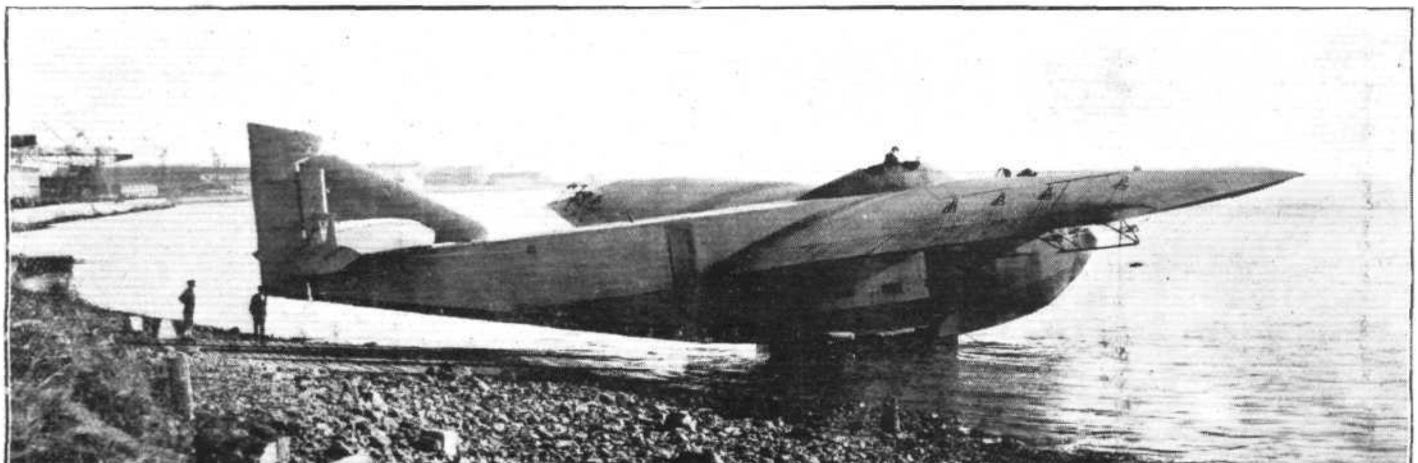
We understand that it is the intention of Lieut. Bernard to fly back to Marseilles by way of Lake

Tanganyika, Lake Victoria, the valley of the Nile, and along the Mediterranean. We are quite sure that wherever he comes in contact with the British Royal Air Force he will receive every assistance, and we wish him every success on his return journey

Airships The visit, on November 17, by members of the Imperial Conference to the airship station at Cardington, Bedford, has once more focussed attention on the airship programme instituted while the Labour Government was in power and Lord Thomson of Cardington was Secretary of State for Air. Visitors upon this occasion had an opportunity of inspecting the new 200-ft. mooring mast that has been erected at Cardington, and also of seeing the experimental bay of the new airship R.101 which has been constructed for test purposes. Elsewhere in this issue an account appears of the visit, from which certain interesting facts emerge. The new mooring mast appears to be a great improvement on the old experimental mast at Pulham, not only because of its much greater height, but in its mechanical details. The erection of similar masts at Ismailia and Karachi will provide bases for the experimental flights to be made when the new airships are completed, and it is to be hoped that one result of the visit to Cardington by members of the Imperial Conference will be that several of the Dominions will see the necessity of putting up similar masts, so that when the preliminary test flights have been made and the new airships are considered satisfactory, it will be possible for the ships to pay visits to some of the more distant parts of the Empire. In no branch of aviation is it more essential to "think Imperially" than in the airship branch. Airships are essentially long-distance craft, and if full advantage is to be taken of them it is absolutely imperative that the Dominions should play their part, and a very important part, in any airship scheme that is to have a chance of success.

We have on more than one occasion expressed doubts as to the feasibility of jumping from existing airships to new types of five million cub. ft. capacity, and the possibility of obtaining some detail information concerning the construction of R.101 was therefore alluring. Unfortunately, the press was not allowed to discover very much in this direction on the occasion of the visit to Cardington, the experimental bay of R.101 being treated as something rather too "secret and confidential" for the press to write about.

It is, however, possible to state, in addition to the already well-known fact that R.101 is to be mainly a steel ship, that she will be constructed of high-tensile steel, mostly in the form of tubes of special construction, and that the work in connection with the drawing of these tubes, some of which have to be made of very considerable length, is being carried out by Boulton and Paul, Ltd., of Norwich. This firm has had unequalled experience of all-steel construction, and to those who have had an opportunity of seeing some of the details of Boulton and Paul aeroplane construction, and some of the special tubes there employed, will probably have no great difficulty in making a rather shrewd guess at the particular type of tube to be used in the R.101. The very fact that the work of making the tubes has been entrusted to this firm helps to inspire confidence, and sufficient was learned at Cardington the other day to make one realise that every precaution possible is being taken to ensure that the new airship shall be adequately strong as regards her structure. Everything is being tested before being adopted, and no innovation is introduced until the most thorough tests have been made. If this policy is followed right through, there seems every chance that the new airship will be a success. She may not quite have the highest possible paying load, nor, perhaps, a very startling performance, but in our opinion that will matter little provided she is *safe*. The other desiderata can be attained later, when we have more practical experience. In the meantime it is satisfactory to find that "safety first" is the watchword of those responsible for the production of R.101.



A GIANT FLYING BOAT : This French seaplane the "Richard-Penhoët," is fitted with no less than five Gnome-Rhone "Jupiter" engines of 420 h.p. each. The machine, which has passed its flight tests successfully, has a wing span of 40 m. (131 ft.), an overall length of 27 m. (89 ft.), a maximum wing chord of 9 m. (30 ft.), and a maximum wing thickness of 1·8 m. (4 ft.). The total loaded weight is 18,000 kg. (32,600 lbs.). The machine cannot be exhibited at Paris as it will not go into the Grand Palais!

THE SUPERMARINE "SOUTHAMPTON"

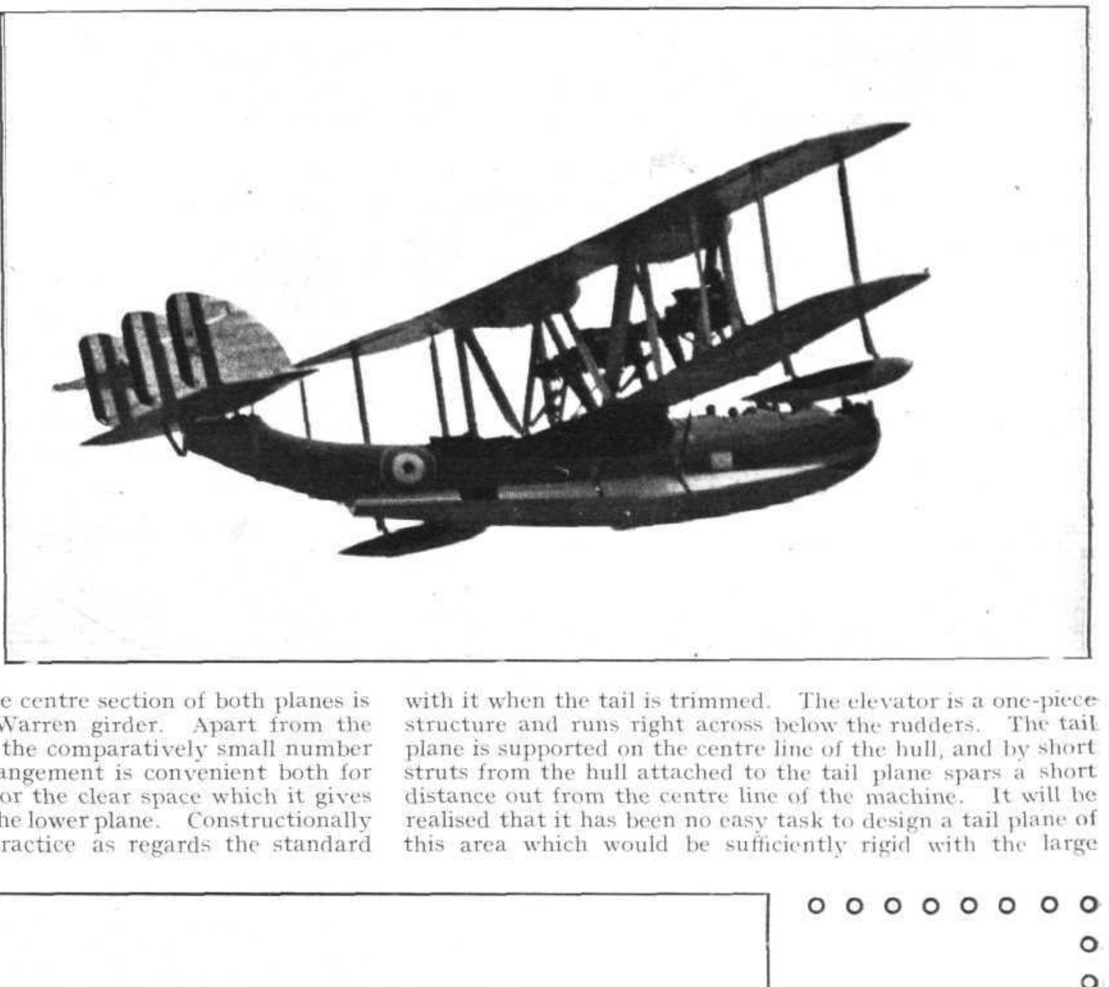
Two Napier "Lion" Engines

(Continued from page 747.)

IN last week's issue of FLIGHT we gave illustrations, general arrangement drawings, and a general description of the Supermarine "Southampton" flying-boat. In the following notes it is proposed to deal briefly with some of the most interesting constructional features of this machine.

The Superstructure

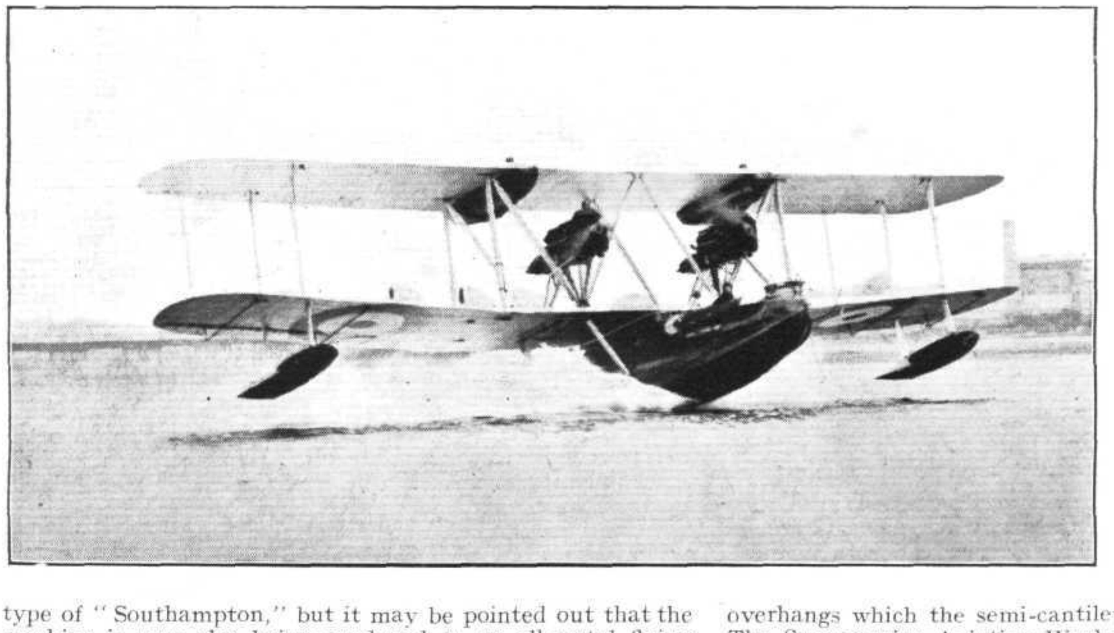
The wings of the "Southampton" are of normal form as regards their biplane arrangement, but the wing bracing is somewhat unusual in that the centre section of both planes is built up in the form of a Warren girder. Apart from the advantages arising owing to the comparatively small number of struts employed, this arrangement is convenient both for the engine installation and for the clear space which it gives across the middle portion of the lower plane. Constructionally the wings follow normal practice as regards the standard type of "Southampton," but it may be pointed out that the machine is now also being produced as an all-metal flying boat, the all-metal feature extending to the wings as well as to the hull. About this, however, nothing may be stated at the moment.



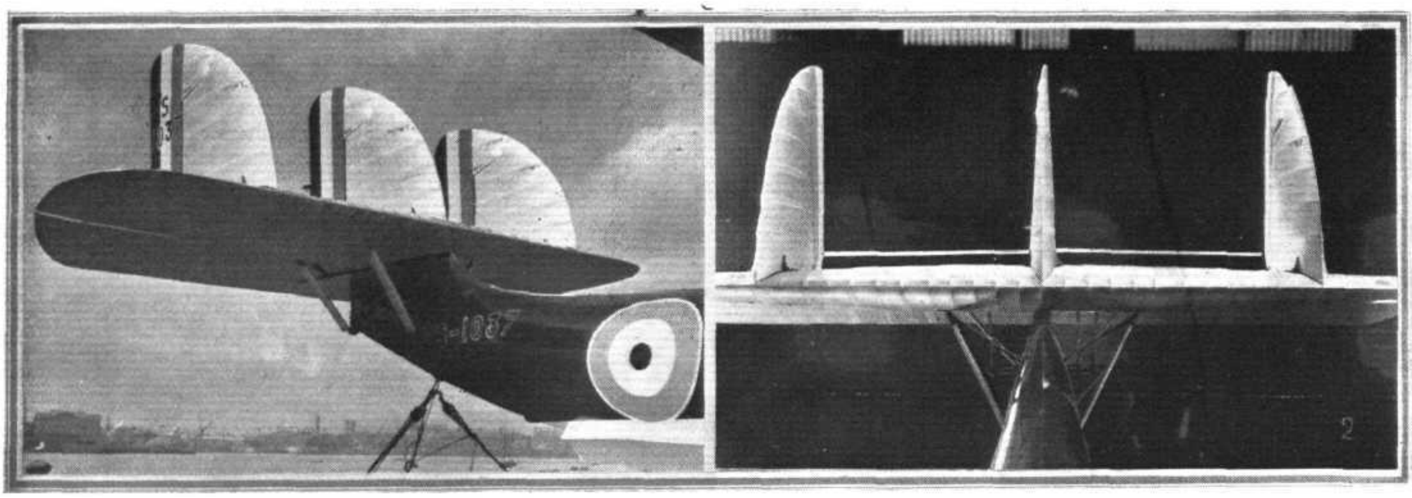
The Supermarine "Southampton" in the air: This machine is capable of flying and manœuvring with one of its Napier "Lion" engines stopped.

Inter-plane struts of somewhat unusual construction are employed on the "Southampton." These consist, as regards the stress-carrying member, of circular section steel tubes, tapered to the ends. These tubes have attached to them light wooden formers and stringers, the skeleton thus produced being covered with doped fabric. The details of the construction are illustrated in a sketch.

Reference was made in last week's article to the somewhat unusual type of tail used on the "Southamptons." This consists of a monoplane tail plane, which is arranged in the form of a semi-cantilever beam, the three vertical fins and rudders being mounted on top of the tail plane, and moving with it when the tail is trimmed. The elevator is a one-piece structure and runs right across below the rudders. The tail plane is supported on the centre line of the hull, and by short struts from the hull attached to the tail plane spars a short distance out from the centre line of the machine. It will be realised that it has been no easy task to design a tail plane of this area which would be sufficiently rigid with the large overhangs which the semi-cantilever arrangement produced. The Supermarine Aviation Works have, however, evolved a special type of planked spars, which give great rigidity and have been found to provide all the stiffness required in the tail. The spars taper from the centre of the machine outwards, so that the section of the tail plane varies gradually from centre to tips. The vertical fins are pure cantilevers supported direct on the tail plane spars. Needless to say, the tail plane



The Supermarine "Southampton" planing just before getting on to its steps. Note the small amount of spray.



THE SUPERMARINE "SOUTHAMPTON": Two views of the cantilever tail, illustrating how little the field of fire is interfered with by the tail.

is provided with a trimming gear, so as to balance the machine in the engine-on and engine-off condition, and also, of course, to allow for any differences in trim due to variations in load.

The Power Plant

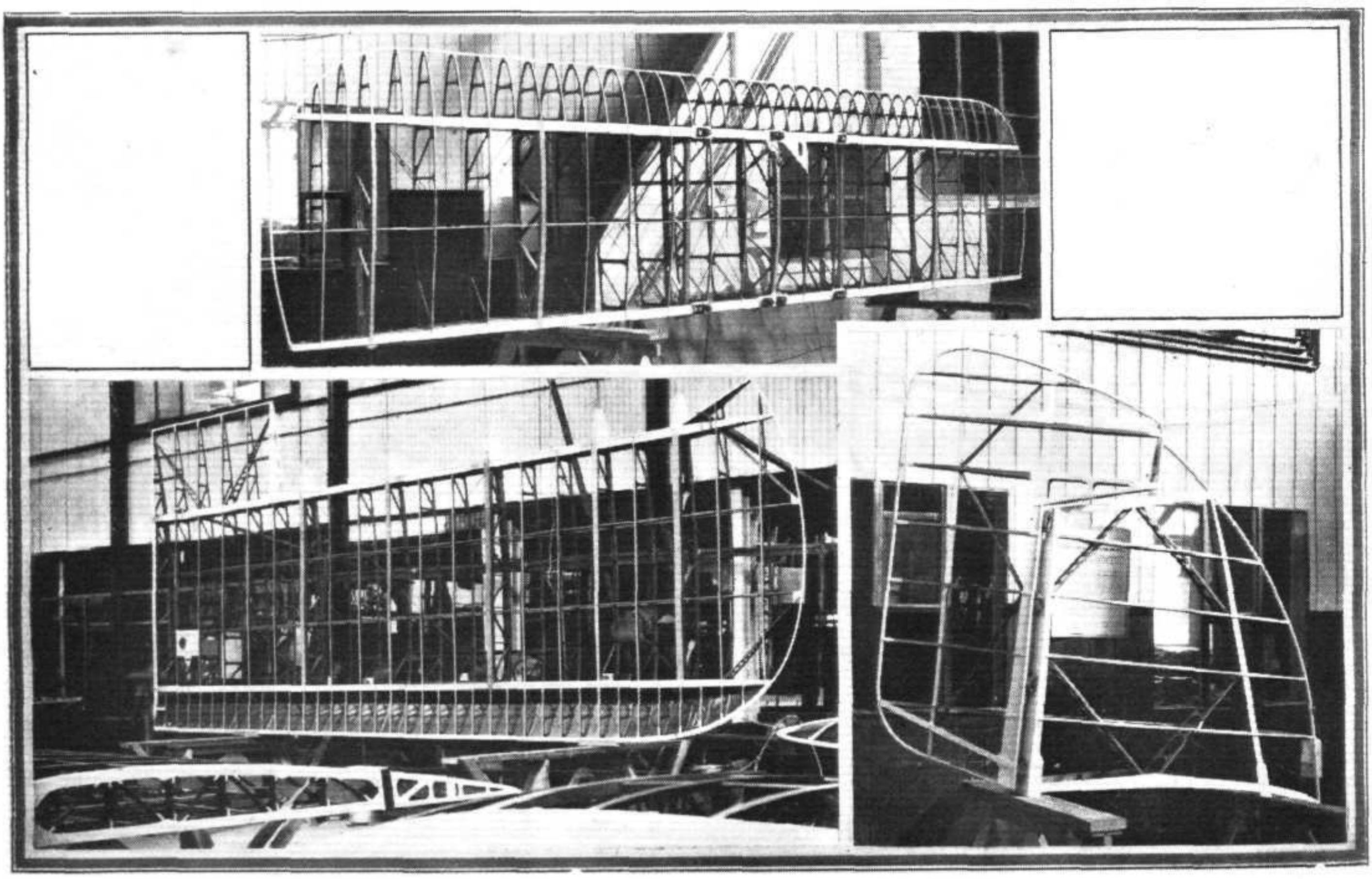
The Napier "Lion" engines are mounted on substantial bearers carried on pin-jointed tubular struts. The engine mountings are separate units mounted on the lower centre section, and can be easily removed without interfering with the wing structure by removing five pins in the strut ends, and by disconnecting the engine controls and petrol leads. Each engine has its radiator mounted in front of it, and an oil tank behind it, which are removed with the engines and mountings. As all the engine instruments are mounted on the engine bearers the complete engine unit can be lifted out of the machine with a sling from directly overhead, the position of the engines forward of the wings rendering this possible.

The petrol system is by gravity feed only, no petrol being carried inside the hull. The two main petrol tanks are slung underneath the top centre section, and are of very large capacity. One of our photographs shows the internal arrangement of baffle plates in a tank.

Hand starting gear is fitted to each engine, suitably geared to make the handles easy to turn. Standard priming pumps are fitted which feed from the filters, and the starting magnetos are geared in with the starting handles. Owing to the absence of wire bracing over the centre portion it is very easy for mechanics to climb down into the rear cockpits after starting up the engines.

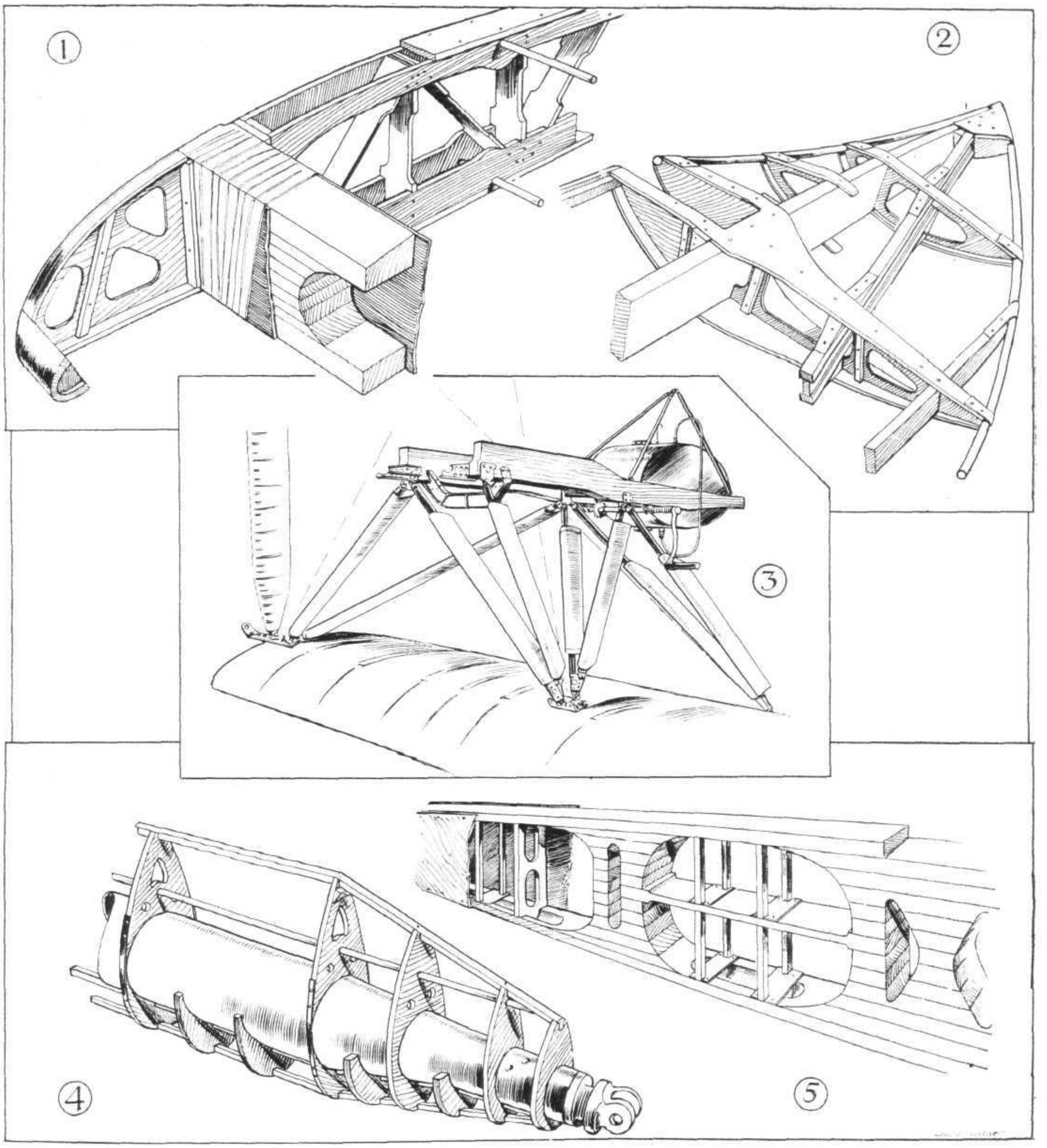
The Boat Hull

The hulls of the standard "Southampton" flying-boats are of all-wood construction, although, as previously mentioned, an all-metal hull is now being produced. Both hulls are of the circular section flexible type. The standard hull embodies all the latest developments in Supermarine wooden hull design, including raised and flared bow, double bottom with air space from bow to rear step, brass running strakes and transom protecting strips. The double bottom is divided into ten



THE SUPERMARINE "SOUTHAMPTON": Photographs of a tail plane, main 'plane, and rudder in skeleton.

watertight compartments, each fitted with draining plugs and vents. The two steps are built in such a way that they can be easily repaired, or completely replaced in case of extensive damage. The main hull is double planked with an inner skin of cedar and an outer skin of mahogany, a layer of fabric being varnished on in between the skins. The planing bottom is double planked with a diagonal skin of cedar and a fore and aft skin of mahogany, with a layer of fabric in between ironed on with marine glue. It is treated outside with a special black varnish preparation which acts as a very efficient anti-fouling agent, and gives a surface of very small frictional resistance. All timbers, hoops and saddles are of best quality American elm, while the keel and keelson are of American elm and mahogany. The springers are of grade A spruce. The entire construction of the hull utilises the through-fastening principle, and all fixings are of copper and brass. As mentioned last week, the circular type of construction gives a hull entirely free of obstruction inside from bow to stern.



THE SUPERMARINE "SOUTHAMPTON": Some constructional details. 1 shows details of the bottom centre-section wing, the rib illustrated being the outer rib on the starboard side. The circular section stringers are of wood. In 2 is shown the construction of an aileron, while 3 illustrates the mounting of the starboard engine. The engine-bearer structure is independent of the wing structure. The interplane struts of the "Southampton" are of somewhat unusual construction, being steel tubes with wood skeleton fairings and fabric covering. Details are shown in 4. A tail-plane spar is illustrated in 5.

The wing tip floats of the Supermarine "Southampton" are of somewhat unusual design, and are chiefly remarkable on account of their very pronounced V-bottom. The floats are of large buoyancy, and are designed to use their full buoyancy with a very small lateral angular movement of the machine. This feature is obtained by making the floats long and shallow, and of comparatively small maximum cross-section. Both

Fuelling a Supermarine "Southampton" in front of the works.

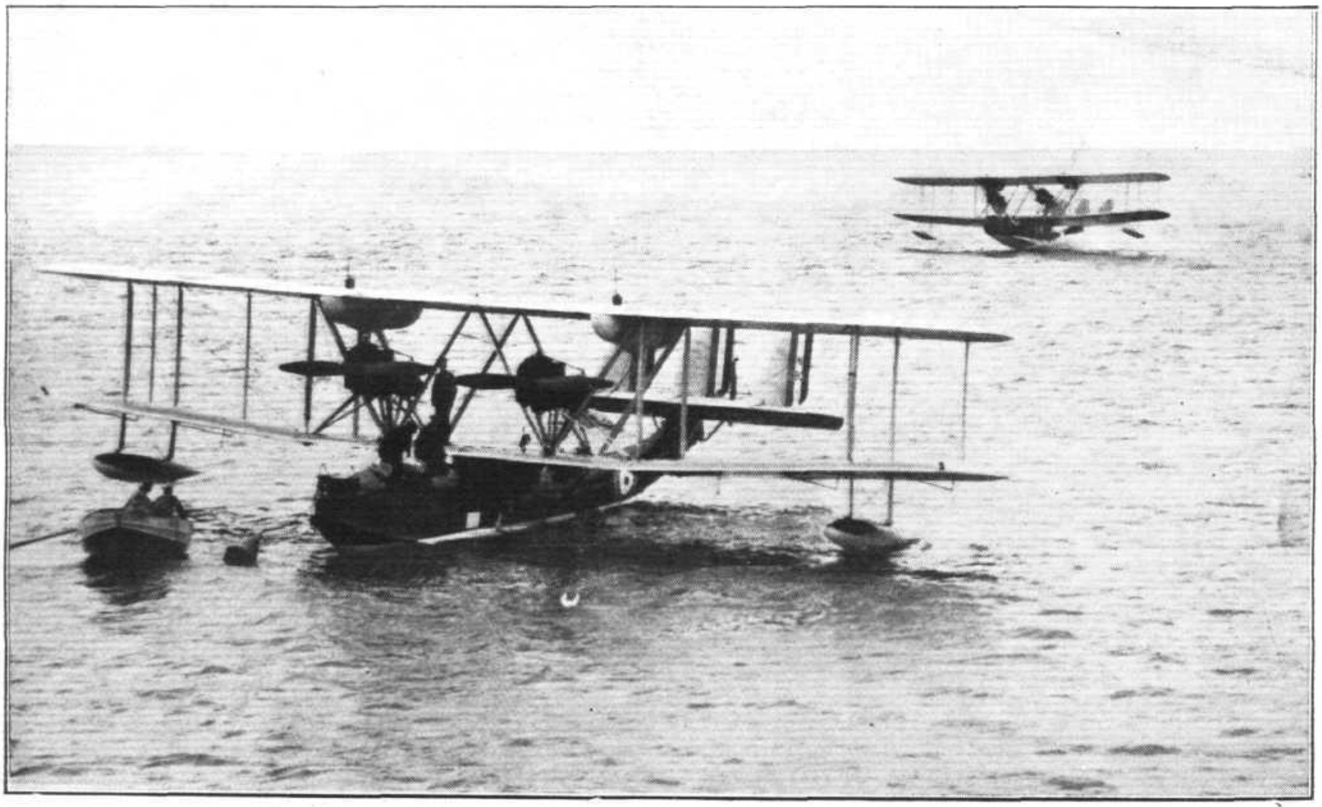
from an aerodynamic and hydrodynamic standpoint the floats are of very low drag, which, apart from the beneficial effect on performance, also prevents the machine from being yawed by the floats while taking-off or landing. Each float is divided into eight watertight compartments fitted with drain plugs.

Controls

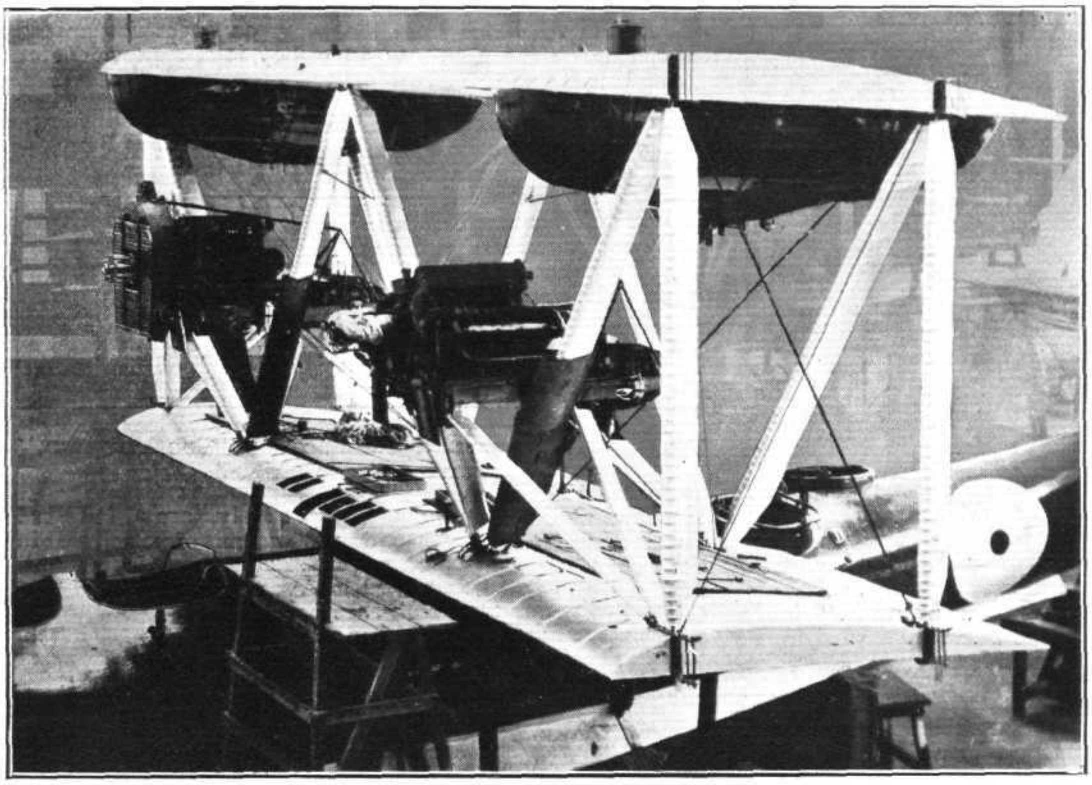
The dual controls of the "Southampton" are arranged in the form of a complete unit, a photograph of such a control unit being published this week. The complete control unit is mounted on a separate braced base, carried on tubular steel members from points of attachment in the hull. This base carries the control columns, adjustable rudder bars and seats, and the arrangement is such as to make the whole control unit very accessible. The unit can be taken from the hull and replaced very easily. The two control columns are connected below their fulcrum by a tubular shaft, and a second shaft runs from the rear column to a cross lever at the rear end of the control frame.

The elevator is operated by forward and backward movements of the shafts, which carry large "bloater" levers on the port side of the control frame. From this there is a clear cable run along the inside of the hull to a lever on a torque shaft running across the hull a few feet from the stern. The rudders are operated by a similar torque shaft in the stern of the hull, and again there is a clear run for the cables up to the control frame. The rudder bars have pedals, so arranged as to make adjustment easy to suit the comfort of pilots of varying heights.

The ailerons are operated through the torque shaft on the



Two Supermarine "Southamptons" off Cromer: The machine in the background is alighting, while that in the foreground is already moored.



The centre section of a Supermarine "Southampton," showing the mounting of the two Napier "Lion" engines.

under-side of the control frame. The rear shaft carries operating levers on its aft end, from which aileron control cables run out to the wings. In this way control pulleys and leads are reduced to a minimum.

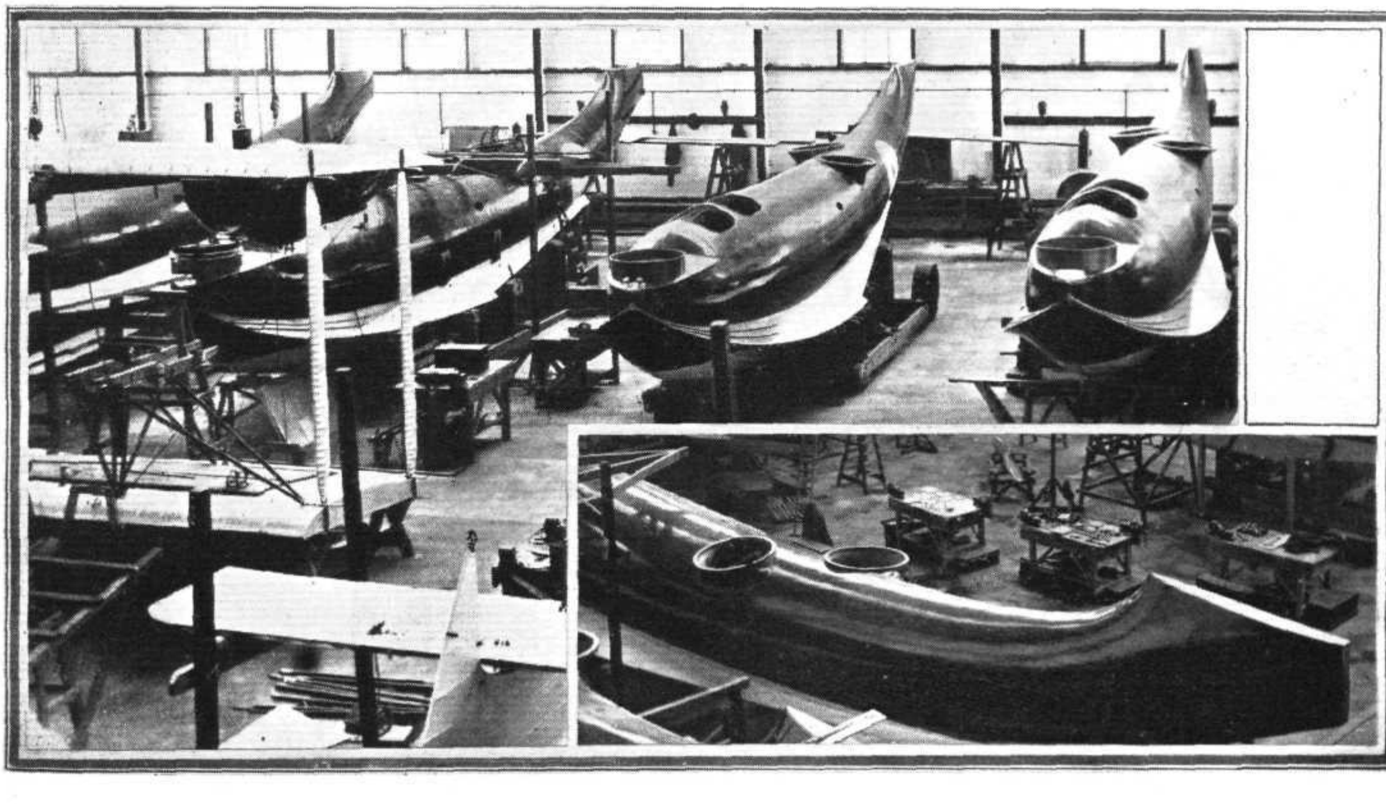
The engine controls are mounted on the port side of the pilots' cockpits, and are so arranged that the engines can be controlled either together or independently. Push and pull rods and bell crank levers are used to take the controls into the lower centre section planes, in the leading edge of which torque rods run to points immediately in front of the engines, whence there is a straight run up to the engine levers themselves.

The cockpits are roomy and comfortable, and allow complete freedom of action, and the occupants are adequately protected from winds and spray. Hinged map boards and cases and writing pads with pencil clips, etc., are provided for both pilot and navigator.

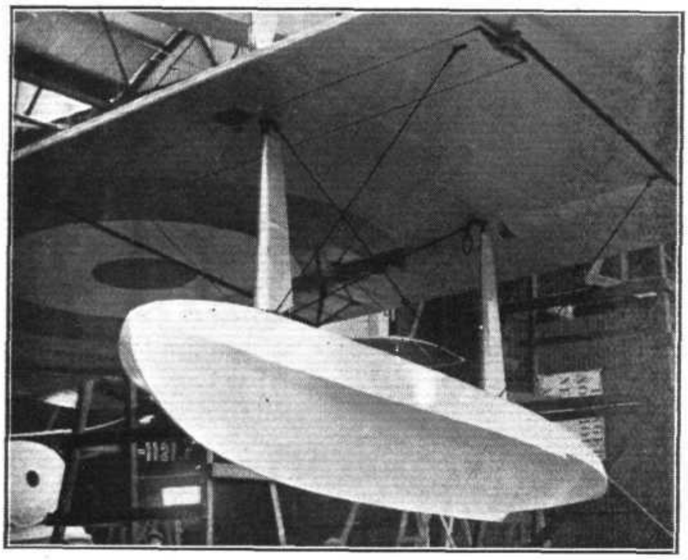
Adequate provision is made for rapid and easy movement of the crew between all cockpits and cabins. An unobstructed passage is provided, running from the forward gun ring right through to the stern of the hull. Any member of the crew can leave his seat and walk to any other member of the crew without disturbing in the least degree those he has to pass. In the pilot's and navigator's cockpits there is room for another member of the crew to stand alongside and converse.

The Beaching Chassis

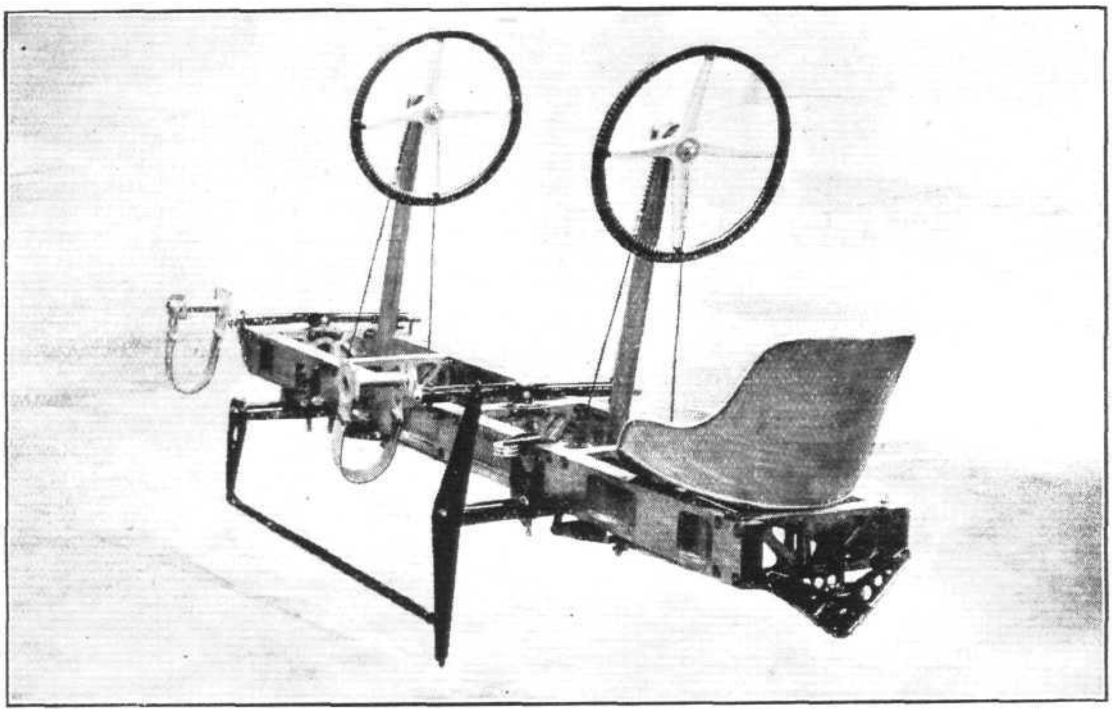
The old-fashioned launching cradle has been superseded in the "Southampton" by a new type of easily detachable launching chassis, which enables the machine to be man-handled with ease. Each side of the chassis forms one unit, and is attached on the three-point principle, and can be removed by the withdrawal of three pins on each side of the machine. The chassis can also be fitted to the machine when in the water before drawing up the slipway. A fairly detailed description and illustrations of this type of beaching



HULLS FOR THE SUPERMARINE "SOUTHAMPTON": Note the staggered cockpits for the rear gunners.



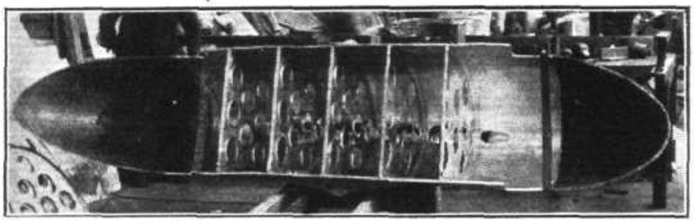
One of the wing-tip floats of a "Southampton." Note *the pronounced Vee bottom.*



The controls on the Supermarine "Southampton" are built up in the form of complete units, one of which is shown in this photograph.

chassis was given in the AIRCRAFT ENGINEER for March 25, 1926, so that a detailed description of it is not thought necessary here. It may be mentioned, however, that one advantage of this type of beaching chassis, apart from the ease with which the machine can be handled by its use, is that it supports the machine from the wings and does not impose any strain on the hull. A tail trolley is also provided for fitting just ahead of the rear step.

The Supermarine "Southampton" can also be supplied fitted with two Bristol "Jupiter," Series VI, engines, in which case the loads carried when the machine is used for



View inside a main petrol tank of the "Southampton," showing baffle plates.

bombing and reconnaissance respectively, are 6,110 lbs., the figure in the former including 400 gallons of petrol, and in the latter 500 gallons of petrol. The figures for weight, empty, load carried and total loaded weight are 8,190 lbs., 6,110 lbs., and 14,300 lbs. respectively. The estimated performance is as follows :—Top speed at sea level, 109 m.p.h. (175·5 km/h.) ; rate of climb at sea level, 643 ft./min. ; ceiling, 14,700 ft. (4,500 m.); minimum flying speed, 56 m.p.h. (90 km/h.) ; optimum cruising speed, 85 m.p.h. (137 km./h.) ; range at cruising speed on 500 gallons of petrol, 850 miles (1,370 km.).

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Westland Aircraft Society (Petters, Ltd.)

IT has been decided that to enable members to put forward their views for the consideration of the Committee, a Suggestion Book should be started. This book will normally be kept by the Secretary, but any member can borrow it in order to enter therein any suggestion to further the interests of the Society.

In connection with the Course of Lectures for Prospective Ground Engineers, the following preliminary syllabus has been arranged :—

Already given.—October 27, Mr. W. G. Gibson, "Erection and Rigging" ; November 4, Mr. W. G. Gibson, "Faults on Flight Tests, Diagnosis and Correction" ; November 10, Mr. H. H. W. Vowden, "The A.I.D." ; November 17, Mr. Fletcher (of "Titanine"), "Dopes, Lacquers, &c."

November 25, Mr. T. Carey, "Aircraft Timbers" ; December 1, Mr. V. S. Grant, "Seaplane and Flying Boat Construction" ; December 8, Mr. R. C. Taylor, "Component Checking and Inspection" ; December 15, Mr. Gibson, "Defects and Deterioration" ; December 22, Mr. Sutcliffe, "Testing of Materials."

As regards the "General Interest" lectures, the second of these was given on November 19, when Mr. Adams, of Bruntons, Ltd., gave a lecture on "Cold-Worked Steels used in Aircraft." The next lecture will be given on December 3, when Squad.-Leader Gregory will speak on "Some Experiences in Iraq, with special reference to Wireless."

Flying Accident

WE sincerely regret to have to place on record the first fatal accident to happen on a D.H. "Moth." The mishap, the cause of which is at present unknown, occurred on November 22, the pilot being Mr. Sydney St. Barbe, one of the London club instructors, who had with him as passenger Mr. J. F. N. Michie. Mr. Michie, who was a ground engineer at the club, was killed, but the pilot escaped with concussion and a broken ankle. He is reported to be progressing satisfactorily.

The AIRCRAFT ENGINEER

FLIGHT ENGINEERING SECTION

Edited by C. M. POULSEN

November 25, 1926

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OUR CONTRIBUTORS

Prof. E. Everling, whose article, entitled "Comparative Quantities in Aircraft Statistics," appears in the present number of THE AIRCRAFT ENGINEER, is a well-known writer on aerodynamics in Germany, and it is with very great pleasure that we introduce him to our readers this week. We use the expression "introduce" advisedly, because it is an unfortunate fact that, although in Germany it is the rule rather than the exception for all seriously interested in aeronautics to follow closely what is written on the subject in other countries, in England we are a little apt to let the language difficulty stand in the way of our study of foreign technical literature. Thus we fear that the work of Prof. Everling, as of that of a number of other prominent German writers, may not be as widely known in this country as it deserves. We hope in the future to do our small share by publishing, as occasion affords, translations of articles by foreign writers on aeronautical subjects. Unfortunately, THE AIRCRAFT ENGINEER is not yet of sufficient size to allow of publishing all that deserves to be published, but we do feel that even an occasional article from a foreign writer may do a good deal towards an interchange of ideas and viewpoints.

The three quantities which Prof. Everling has put forward seem to offer a convenient means of comparing the efficiency of different machines and, although the fact that throughout the article German expressions and coefficients, as well as metric units, are used will doubtless prove slightly bewildering to some, there should be no great difficulty in following the writer's arguments. The numerical values of the three quantities are, of course, those based on Continental units, but as they are intended merely for comparative purposes, this should not greatly matter.

Mr. J. D. North continues this week his series of articles on "Aircraft Performance," and more particularly on structural policy in design, dealing mainly with the effect of changes in gap/span ratio. He arrives at the conclusion that a change of gap of 10 per cent. has made no difference to the weight of the wings, the increase in weight of struts having just balanced out the reduction in weight of the spars and wires. The article has been written under great difficulties, as Mr. North has been suffering from a touch of influenza, but he carried on and completed the article rather than disappoint our readers, a fact which they will, we feel sure, greatly appreciate.

COMPARATIVE QUANTITIES IN AIRCRAFT STATISTICS.

By Professor E. EVERLING.

[IN the May 28, 1926, issue of the *Zeitschrift für Flugtechnik und Motorluftschiffahrt* (generally given in the slightly more convenient form "Z.F.M.") there appeared an article entitled "Vergleichsgröszen zur Flugzeugstatistik" by Professor E. Everling, which contained the derivation of three new quantities intended to facilitate comparison between various machines as regards efficiency. Hitherto a comparison between machines has been no easy matter, and it was thought that the new quantities might afford a means of rendering this possible. Consequently we approached Professor Everling and the Editor of the "Z.F.M." for permission to translate the article for the benefit of readers of THE AIRCRAFT ENGINEER, and this permission was willingly granted.

The task of translating the article has been no easy one, mainly because in the majority of instances no English translation existed which would adequately represent the meaning of the original German expression, and so a fair number of English expressions have had to be "coined." The Editor of THE AIRCRAFT ENGINEER does not claim that these translations are always the best possible, and will be glad to receive suggestions for improvement before some of the coined words definitely pass into the English language. The matter is one of considerable importance, not with regard to the present article only, but in aeronautical literature generally, and it is undesirable to introduce fresh expressions unless these are to be generally accepted and "standardised" as it were.

Professor Everling's article, as originally published in the "Z.F.M.," contains a very great number of footnotes giving references to other works by the same author and by others. As in the vast majority of cases British readers of THE AIRCRAFT ENGINEER will not have access to these works, all of which are contained in German publications, it has not been thought necessary to quote the majority of these footnotes. This should not, however, be taken as proof that Professor Everling has failed to give chapter and verse for his claims, and those sufficiently interested in the details of the derivation of the three new quantities "high-speed figure," "distance-figure," and "altitude-figure," are advised to refer to No. 10 of 1926 of the "Z.F.M."

As regards the use of the Everling quantities, in the future we propose to follow the example of the "Z.F.M." and give the values of these three quantities in machine descriptions wherever the necessary information is available. By adhering to the original units direct comparison with foreign machines becomes possible.—EDITOR.]

Statistics relating to aeroplanes already constructed should not be neglected as a suitable source of assistance in aerotechnical investigation. Usually, in aircraft descriptions, the values of wing loading, power loading, and, more recently, of the ratio of engine power to wing area,* are stated. In addition to these values, which are not directly comparable, the following come into consideration :—

(*a*) The "high-speed figure" (*Schnellflugzahl*), which is a comparative figure for the speed with reference to the "wing-power."

(*b*) The "distance-figure" (*Weitflugzahl*), which is the speed converted according to the power loading (not an optimum value, but a quantity corresponding to the angle of incidence at the measured speed).

(*c*) The "altitude-figure" (*Hochflugzahl*), which is the ceiling referred to unit "loading-figure" (*Bauzahl*), this, in turn, being the power loading multiplied by the square root of the wing loading.

These three figures correspond to the propeller efficiency divided by: (*a*) The drag coefficient; (*b*) The gliding angle or D/L, and (*c*) The "flight-figure" (*Flugzahl*).

Aircraft statistics do not yet occupy, within the scope of theoretical aeronautical investigation, the place which they deserve. The numerous data in the descriptive articles in the technical press still require to be sifted and utilised in accordance with certain viewpoints.

In order to facilitate this for various purposes, it is intended that in the future the aircraft descriptions appearing in the "aviation review" of the Z.F.M., and the technical section of the (German) "Aviation Notices" (which correspond somewhat to our "Air Ministry Notices."—ED.) shall be supplemented in this direction. In these are given from the technical press, as well as from special reports from at home and abroad, data relating to dimensions, weights, performances and qualities which permit of either a direct comparison of individual machines, or of checking the data given for misprints or for intentional "colouring." This shortcoming is only partly remedied by always giving, provided the available data permit of doing so :—

(1) The wing loading G/F, in kg./sq. m.
(2) The power loading G/N, in kg./h.p.
(3) The "wing-power" N/F, in h.p./sq. m.

(3) is obtained by dividing (1) by (2) and is scarcely ever stated in technical literature on the subject, although it is of great importance for the purpose of speed estimates, as the following considerations will show.

These three quantities in themselves mean very little, not least because they can be given for an aeroplane which has never flown. They should rather be compared with the results of reliable flying tests, and particularly with the measured speed and ceiling. When that is done, it is possible to derive comparable values which afford a measure of the efficiency in one respect or another.

In the case where no flying test results are available, but only estimated performance figures, these same quantities provide a means of ascertaining whether or not the predictions were too optimistic. Finally, the upper theoretical limits, or optimum values, of these comparative quantities can be quantitatively given, as well as the values already attained in practice, and thus the progress of development.

To begin with, the following three quantities come into consideration :—

(*a*) the "high-speed figure" $\frac{\eta}{c_w}$

(*b*) the "distance-figure" $\frac{\eta}{\epsilon}$

(*c*) the "altitude-figure" $\frac{\eta}{\kappa}$

in which the following notation is used :—

η for the propeller efficiency,

c_w for the drag coefficient corresponding to

c_a for the lift coefficient,

$\epsilon = \frac{c_w}{c_a}$ for the gliding angle, or D/L,

$\kappa = \frac{c_w}{c_a^{1\cdot5}} = \frac{\epsilon}{\sqrt{c_a}}$ for the "flight-figure," all unknown.

Concerning the notation we must go back to the well-known relations from the mechanics of flying :—

Lift (kg.) $A = c_a \frac{\gamma}{2g} v^2 F$,

in which—

γ = the weight of air, *i.e.*, weight in kg./cu. m.

$\frac{\gamma}{g}$ = the air density (kgs. ²/m.⁴)

v = the velocity in metres per second, *i.e.*, $V = 3\cdot6v$ in km/h.

F = wing area in sq. m.

For steady horizontal flight at any altitude, also at the ceiling, the following holds exactly, and for steady climbing flight approximately :—

Weight = Lift, G = A.

Furthermore, the propeller horse power $75\eta N$ (kgm./sec.) is divided into two parts, of which one is required for sustentation in horizontal flight, while the other is a surplus required for acceleration and particularly for climbing :—

$75\eta\, N = Wv + Gw$;

in other words, the rate of climb w (m/s) equals the available surplus of power referred to unit weight :—

$$w = 75\eta\frac{N}{G} - \frac{W}{G}v = 75\eta\frac{N}{G} - \epsilon v = 75\eta\frac{N}{G} - \kappa v_1$$

Introduced here is the "unit speed" v_1 (m/s) in abbreviated form†

$$v_1 = v\sqrt{c_a} = \sqrt{\frac{2g}{\gamma}\cdot\frac{G}{F}} = \sqrt{\frac{2g}{\gamma_0}\cdot\frac{G}{F}}\sqrt{\frac{\gamma_0}{\gamma}} \approx 4\sqrt{\frac{G}{F}}\sqrt{\frac{\gamma_0}{\gamma}}$$

"Unit speed" is the speed corresponding to the angle of incidence at which $c_a = 1$.

For horizontal flight the "high-speed figure" is given by the thrust horse-power, together with the relation for the drag coefficient :—

"High-speed figure" $\frac{\eta}{C_w} = \frac{v^3}{75}\cdot\frac{\gamma}{2g}\cdot\frac{F}{N} = \frac{V^3}{7{,}000}\cdot\frac{\gamma}{g}\cdot\frac{F}{N}$;

At ground level the simple equation

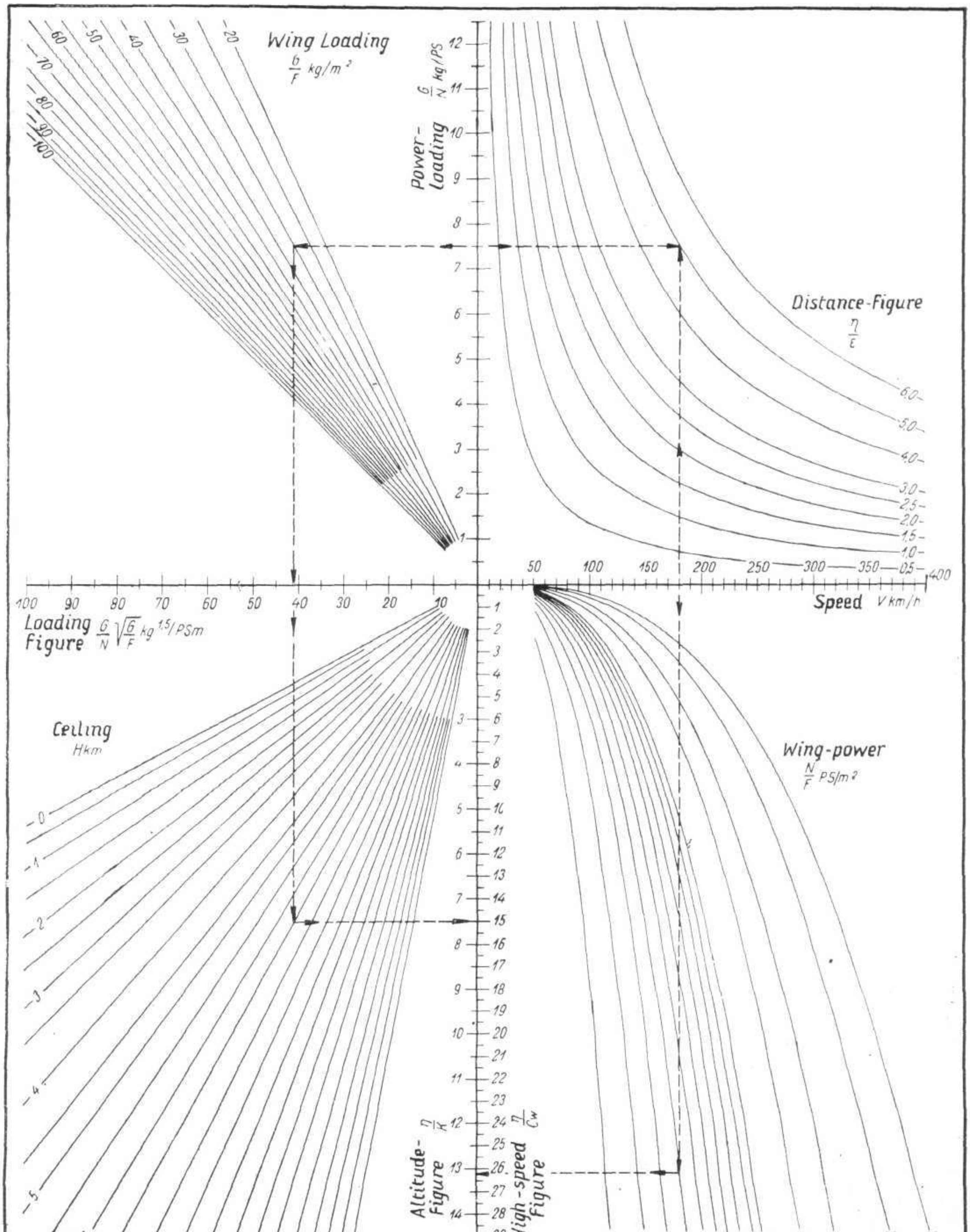
$$\frac{\eta}{c_w} = \frac{V^3}{56{,}000}\cdot\frac{F}{N}$$

holds good. Thus the "high-speed figure" is obtained by dividing the third power of the top speed by the "wing-power," and further multiplying by $\frac{1}{7{,}000}$ of the air density at which the speed was measured. In this way the speed is converted in a manner which is equal for all aeroplanes, and as a measure of the efficiency one obtains the relation between airscrew efficiency and the smallest, *i.e.*, most favourable, drag coefficient. For very fast machines the optimum airscrew efficiency approaches very close to 1.

The drag coefficient is composed of detrimental resistance, which may be reduced to round about 0·017, the profile drag, for which one may assume an "ideal" value of 0·008, and the induced drag, which, for the low lifts that come into consideration here, may be neglected. Thus we arrive at an "ideal" value of the "high-speed figure" of 40. In machines hitherto constructed the practical value of this figure is considerably smaller, probably round about half.

* For this expression we suggest the English translation "Wing-power."—Ed.

† The last form is due to the fact that at ground level $\frac{\gamma_0}{g} \approx \frac{1}{8}$ kg s²/m⁴.



NOMOGRAM FOR FINDING "HIGH-SPEED FIGURE," "DISTANCE FIGURE," AND "ALTITUDE FIGURE"

The dotted lines illustrate an example. Note particularly the direction of the arrows.

The "Distance-figure."

From the last form but one of the equation for rate of climb, w, is obtained, when we take $w = 0$,

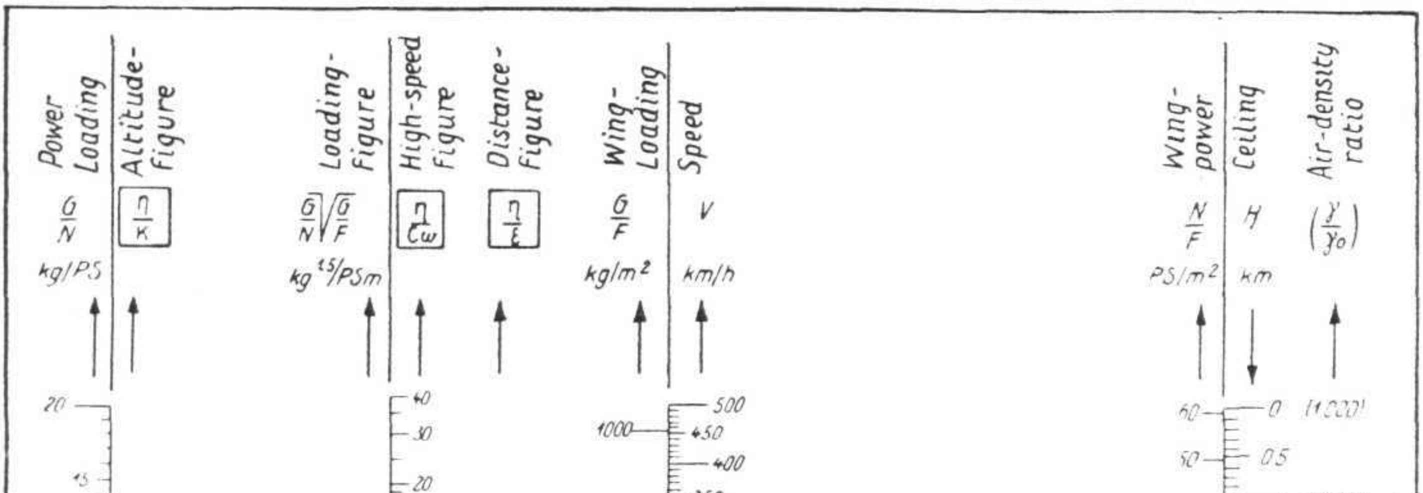
$$\text{"Distance-figure"}\ \frac{\eta}{\epsilon} = \frac{v}{75} \cdot \frac{G}{N} = \frac{V}{270} \cdot \frac{G}{N}.$$

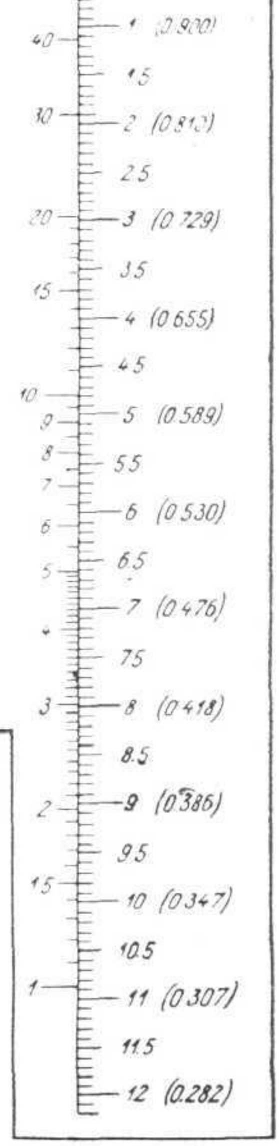
According to this, the speed should be converted by multiplying it by $\frac{1}{270}$ of the power loading. One should bear in mind, however, that by so doing a correct scale of comparison is obtained for similar machines only, since the best gliding angle ϵ is not obtained, but a greater which corresponds to a smaller angle of incidence, *i.e.*, to a better drag coefficient, c_w, and a higher speed, v. In general, the data given in aeroplane descriptions and obtained from flying tests do not permit of giving the optimum value of $\frac{\eta}{\epsilon}$. Nevertheless, this figure should always be taken into account, especially as it gives a certain measure of the flight economy. (GV = total flying weight × speed is the "wattless" soaring power. (*Schwebeleistung*), which is in proportion to the engine power used.)

If, now, we introduce furthermore the flying range $s(km)$, the duration t (hours), the total weight of fuel carried B (kg), for a unit fuel consumption b ($kg/hp/h$), the last equation may be written:

$$\frac{\eta}{\epsilon} = \frac{1}{270} \cdot \frac{G}{N}\frac{s}{t} = \frac{b}{270} \cdot \frac{G}{B}s.$$

Thus the "distance-figure" bears its name justly, since it indicates what distance a machine can cover with a power





Graph for finding "High-Speed Figure," "Distance Figure," and "Altitude Figure."

How to use the Graph: Draw a straight line through the given wing loading and the given power loading, and on the projection of this read off the "wing power." A straight line through the "wing power" thus found and the given speed gives the "high-speed figure." (This is an optimum value in the case of the top speed.)

The "distance figure" is found on the same scale as the "high-speed figure" by drawing a line through the given power loading and the given speed. (This is not an optimum value, but refers to the angle of incidence corresponding to the speed.)

The straight line through wing loading and power loading used for finding the "wing power" also gives, on another scale, the "loading figure." A line through the "loading figure" thus found and through the given altitude gives the "altitude figure," which is an optimum value when the altitude is the ceiling.

plant of given economy, provided the proportion of fuel weight to total loaded weight $\frac{B}{G}$ is known. If the engine works with the same consumption at all air densities, the altitude does not enter into the last form of the equation at all. Consequently one can fly farthest on a given quantity of fuel at the altitude at which the attitude of the angle of incidence corresponds to the best gliding angle ϵ, *i.e.*, to the most economical flying condition.

The "Altitude-figure."

As contrasted with the "distance-figure," the "altitude-figure" again represents an optimum value. It can likewise be derived from horizontal flight, and even for any desired altitude from the last form of the equation given above for rate of climb w, when again w is taken $= 0$.

$$\frac{\eta}{\kappa} = \frac{v_1}{75} \cdot \frac{G}{N}.$$

This relation of propeller efficiency η to "flight-figure" μ is, however, an optimum value only when either $N = N_{min}$, *i.e.*, the lowest power required at the altitude in question, or G is the greatest load that can be sustained at this altitude or, what amounts to the same thing mechanically, the altitude is the greatest attainable, *i.e.*, is the ceiling. For "unit speed" we must then write:

$$v_1 = \sqrt{\frac{2g}{\gamma_0} \cdot \frac{G}{F}} \sqrt{\frac{\gamma_0}{\gamma_g}} \approx 4 \sqrt{\frac{G}{F}} \left(\frac{\gamma}{\gamma_g}\right)^{0.5}$$

in which γ_g is the weight of air at the ceiling. The engine power thereby falls off to the value N_g. As, however, the engine power does not fall off with altitude exactly in proportion to the air density but with its 1·25th power, *i.e.*, $N_g = N\left(\frac{\gamma_g}{\gamma}\right)^{1.25}$, one obtains for the calculation of the "altitude-figure" from the power loading $\frac{G}{N}$ and wing loading $\frac{G}{F}$, in other words, from the "loading-figure" $\frac{G}{N}\sqrt{\frac{G}{F}}$ as well as from the ceiling air density ratio $\frac{\gamma_g}{\gamma}$ the

$$\text{"altitude-figure"} \ \frac{\eta}{\kappa} = \frac{4}{75} \cdot \frac{G}{N} \sqrt{\frac{G}{F}} \left(\frac{\gamma}{\gamma_g}\right)^{1.75}$$

$$= 0{\cdot}053 \frac{G}{N} \sqrt{\frac{G}{F}} \cdot 10^{0.081H} = \frac{1{\cdot}21^H}{18{\cdot}8} \frac{G}{N} \sqrt{\frac{G}{F}}$$

where H is the ceiling in km., and is connected with the air density ratio according to the general relation

$$\frac{\gamma}{\gamma_0} = 10^{-0.46H} \approx 0{\cdot}9^H$$

Thus the "altitude-figure" is found from 0·053 times "loading figure" by multiplication by a figure which increases exponentially with the measured ceiling, and which for $H = 0$ has a value of 1, while for $H = 12{\cdot}2$ km. (approximately the present altitude record) its value is 10.

The "altitude-figure" can also be calculated from the climb at any height when either one assumes a suitable value for the propeller efficiency η or for the "flight-figure" κ. The relation given above for the rate of climb w gives:

$$\frac{\eta}{\kappa} = \frac{v_1}{75} \cdot \frac{G}{N}\left(1 + \frac{1}{\kappa} \cdot \frac{w}{v_1}\right)$$

or

$$\frac{\eta}{\kappa} = \frac{v_1}{75} \cdot \frac{G}{N} : \left(1 - \frac{w}{75\eta} \cdot \frac{G}{N}\right)$$

Finally, the "altitude-figure" $\frac{\eta}{\kappa}$ can be expressed in a form similar to that for the "distance-figure" $\frac{\eta}{\epsilon}$ by introducing either the fuel weight B, or the unit fuel consumption b, and the greatest duration of flight $t_{gr.}$:

$$\frac{\eta}{\kappa} = \frac{b}{75} \cdot \frac{G}{B} v_1 t_{gr}.$$

Thus, for a power plant of given economy b and a given ratio of fuel weight B to total loaded weight G, the "altitude-figure" $\frac{\eta}{\kappa}$ represents at the same time the distance which can be covered at "unit speed," or by a given "unit speed," or wing loading $\frac{G}{F}$, the greatest possible duration t_{gr}.

For the conversion of measured performances these data are as little suitable as in the case of the "distance-figure," and it will be much preferable to use for this purpose the ceiling, as indicated above.

The "high-speed figure," "distance-figure" and "altitude-figure" all have the property that they are better the greater they are (as distinct, for instance, from the drag coefficient c_W, the gliding angle ϵ and the "flight-figure κ). In order to enable them to be found rapidly and with some exactness from the given or measured quantities, I have prepared the accompanying nomograms, in the production of which I owe a great deal of thanks to my assistant, Herr Dipl. Ing. Gerbert Hübner.

Fig. 1 shows a wing nomogram which can be used either with a set-square for determining the vertical and horizontal lines, or more simply draw them in on squared paper. Unfortunately, it is necessary to draw horizontal and vertical lines to each of the curves or straight lines in the four quadrants, and to swing them through a right-angle in order to read off the result on the other co-ordinate scale. In the case of more than three variables, such as when finding the "altitude-figure," it becomes necessary to go from one quadrant to another.

Much simpler (in that case) is the graph, Fig. 2, which contains all eight variables of the three quantities on but four parallel scales, the simplest possible form of such a graph. It is true that a straight-edge is required in order to read off the values, which may best take the form of a straight line scratched on a celluloid set-square, but at a pinch a horse-hair pulled out of one's armchair will do! In this graph each variable occurs but once, and the "wing-power" and "characteristic-figure" can be read off from the power loading and wing loading in one placing of the straight-edge. If the straight-edge is placed through "wing-power" and speed, or through power loading and speed, or through "loading-figure" and ceiling, one obtains one after the other the "high-speed figure," the "distance-figure" and the "altitude-figure."

AIRCRAFT PERFORMANCE

Structural Policy in Design

By J. D. NORTH, F.R.Ae.S.

(*Continued from p. 90.*)

The curves given in the issue of THE AIRCRAFT ENGINEER for October 28, will perhaps be better understood if it is made clear that the abscissæ "total weight" implies a definite span corresponding to each weight, which can be found from the equation

$$\text{Span} = \sqrt{0{\cdot}6\,W}$$

and that changes in span (as in the example worked out) are dealt with by using artificial weight figures corresponding to the correct gap and correcting for the weight by manipulating the load factor. It is important to remember to multiply the factor $\frac{W_p}{W}$ read off by the artificial weight/real weight ratio to get the final result. It must equally be made clear that the values for $\frac{W_p}{W}$ imply no more change in construction than is expressly allowed for in changes of span and chord determined upon and that the gap/span ratio is assumed to remain constant; the method of allowing for alteration in the last will be discussed later. Any such curves

of variation constructed from any set of chosen figures or experimental data will show when compared with other experimental data what advantage or otherwise in the matter of weight has been attained by alteration of the structural arrangements generally.

It is quite obvious from Fig. 17 (AIRCRAFT ENGINEER, October 28, 1926), that it is easier to build light wings for small aeroplanes at a light structure weight than it is to build them for large aeroplanes; a point which, as we have already mentioned in earlier articles, is borne out by experience of actual construction and also by observations of natural flying machines (*e.g.*, birds). These curves, however, must not be considered to have much significance below a total weight of 1,000 lb.

As the economics of structure require the increase of structure weight with increasing $\frac{\text{span}^2}{W}$ to be set off against the reduction in induced drag, Fig. 17 should be used in conjunction with Figs. 10 and 11 (AIRCRAFT ENGINEER, April 29, 1926). Referring back to the example given in last month's article, it was seen that reducing $\frac{\text{span}^2}{W}$ from $0 \cdot 6$ to $0 \cdot 5$ on an aeroplane weighing 10,000 pounds reduced the structure weight of the wings from $15 \cdot 8$ per cent. to $14 \cdot 65$ per cent., and, in consequence, gave a saving in weight of $1 \cdot 15$ per cent. to be set off against the increased fuel required, owing to the induced drag being greater, the balance increasing or decreasing the military load as the case may be. The amount of this extra fuel will depend on the brake thermal efficiency of the engine and the propeller efficiency, and also the operational indicated air speed. For example, if the operational true speed is 100 m.p.h. at 18,000 ft., the operational indicated air speed is about 75 m.p.h.; the induced drag would be increased from roughly, 295 lb. to 365 lb., an increase of 70 lb. This corresponds to, roughly, $18 \cdot 7$ thrust horse-power, and at 70 per cent. propeller efficiency to $26 \cdot 7$ brake horsepower, and hence about $17 \cdot 4$ lb. for fuel tankage per hour of flight. A range of 650 miles will cause the extra fuel to balance the weight saving on the wings. Actually, as weight of wings affects structure to a lesser degree than weight of fuel, the advantage is really greater to the extra span. The advantage to be gained on climb (and climb would be at an indicated speed not exceeding 75 m.p.h.) is obvious.

One may note here how inextricably the economics of the aeroplane are bound up with operational requirements, and how any arbitrary fuel load specified to satisfy certain definite needs as to operational speed and range may tend to produce an uneconomical aeroplane. The greatest possible latitude requires, therefore, to be given to the designer in interpreting operational requirements. The starting point for the aeroplane designer must be the operational results aimed at. The complexity of factors governing the economics of design render any intermediate interpretation of operational requirements *dangerous and misleading.*

It has already been stated that the curves of Fig. 17 are similarity curves based on a definite value for gap/span ratio of about $0 \cdot 11$, and that the correction applied for change of aspect ratio assumed that the gap/span ratio remained unaltered. The influence of this ratio on induced drag was fully explained in an earlier article (29.4.26) and from Fig. 11 it will be seen that the value of σ corresponding to a gap/span ratio of $0 \cdot 11$ is about $0 \cdot 64$ hence $\frac{2}{1+\sigma} = \frac{2}{1 \cdot 64} = 1 \cdot 24$ and this factor has been used to correct the values of lift/induced drag of Fig. 10 in the calculations just previously made.

Gap, however, is frequently determined from other than aerodynamic considerations. In the case of single seater fighters the position of the top plane is generally fixed by the angle which the plane subtends at the pilot's eye, and the arrangement chosen which will give the least obstruction to the pilot's forward and upward view. The position of the bottom plane, to avoid interference, is usually fixed at the bottom of the body and hence since to keep down drag the body is made as small as consistent with a good form, the gap is determined from considerations having no bearing on induced drag. In twin-engined aeroplanes gun-fire and backwards view control the gap, and in some large aeroplanes, shed clearance has actually been a deciding limitation. It is very nearly true to say of military aeroplanes that the choice of gap is independent of the span. Fortunately, however, reasonable aeroplane arrangements give suitable values for gap/span ratio, *e.g.*, between $0 \cdot 1$ and $0 \cdot 15$, with values of σ between $0 \cdot 66$ and $0 \cdot 56$, giving correction factors of approximately $1 \cdot 20$ and $1 \cdot 28$ respectively. It will be noticed that even the enormous change of gap (50 per cent. increase), makes a comparatively small difference to the induced drag. In the example given in last month's article the gap/span ratio would only be altered about 10 per cent., if the gap were kept constant when the span was reduced, and the decrease of induced drag due to the alteration would only be about $1 \cdot 5$ per cent.; this would be about $5 \cdot 5$ lb. under the operational conditions considered.

The influence of change of gap/span ratio is more complicated and quantitatively depends on the type of structural arrangement, *i.e.*, proportions, gap, span, chord and strut spacing, small variations of which are to be considered.

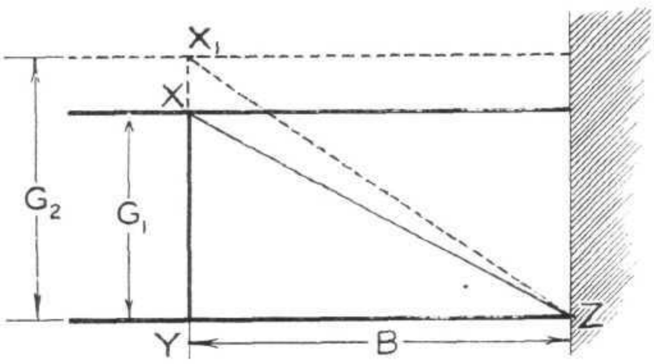


Fig. 19.

Consider the arrangement shown in Fig. 19.

This shows a single bay structure. The length of the bay is B and does not change; the gap changes from G_1 to G_2

Strut.—Consider first the strut: we may either retain the same external profile (supposing the strut to be hollow) and make the walls thicker, or we may enlarge the external profile so as to keep the slenderness ratio constant (constant l/k). In the first case, if the strut is of "high tensile" metal construction within the limits of ordinary aeroplane practice, the value of k is nearly independent of the gauge of material of which the strut is composed. In other words it may be assumed that the thickness of the material is so small compared with the cross-sectional profile dimensions that when the strut is made longer and of heavier material k remains unaltered. For a slenderness ratio appropriate to interplane struts for the strut to be capable of taking the same load (which is of course unaltered) when the gap is increased the cross-sectional area must be increased in the ratio $\left(\frac{G_2}{G_1}\right)^2$ and hence the weight per foot run increases in the same ratio, but as the length is increased the weight

$$W \propto \left(\frac{G_2}{G_1}\right)^2 \times \frac{G_2}{G_1} \propto \left(\frac{G_2}{G_1}\right)^3$$

This is for the strut proper; of course the weight per foot run of the strut fairing will remain unaltered and the weight will vary as $\frac{G^2}{G_1}$

If, however, the slenderness ratio be kept constant, the weight of the strut will vary as $\frac{G_2}{G_1}$, but the weight of the fairing will vary as $\left(\frac{G_2}{G_1}\right)^2$ since the width and breadth of the strut have increased as $\frac{G_2}{G_1}$.

The drag of the strut will, of course, have increased in the ratio $\frac{G_2}{G_1}$ in the first case and $\left(\frac{G_2}{G_1}\right)^2$ in the second.

Wires.—From an inspection of the figure XYZ and X_1YZ are stress diagrams for the two systems. The lengths G_1

and G_2 are of course representing applied loads of the same magnitude.

Hence the load in the wire and consequently its cross-sectional area

$$\propto \frac{G_1}{G_2} \frac{\sqrt{G_2^2 + B^2}}{\sqrt{G_1^2 + B^2}}$$

and the length

$$\propto \frac{\sqrt{G_2^2 + B^2}}{\sqrt{G_1^2 + B^2}}$$

$\therefore$ The weight of wire $\propto \frac{G_1}{G_2} \cdot \frac{G_2^2 + B^2}{G_1^2 + B^2}$

This result cannot of course be considered quantitatively without a knowledge of the ratio of the gap to the bay length (G:B).

If in the initial case G = B and in other cases G = 0·9B, 0·8B, 0·7B, 0·6B and 0·5B.

the ratios of the weights of wires will be

1, 1·005, 1·025, 1·063, 1·133 and 1·25 respectively.

The ratio of the weight of wires in changing the gap by 0·1 B taking each of the above cases in turn as the *original* are then

1·005, 1·02, 1·038, 1·065, 1·078.

It is thus apparent that for the order of changes in gap/span ratio the reduction in wire weight will be small from 0·5 per cent. to 3 per cent. in different bays, according to their geometry. The resistance of the wires will be reduced in direct proportion to the weight reduction supposing the fineness ratio of the cross section of the wires to be constant.

Spar.—In the case of the overhang the spar is, of course, unaffected. In the bay the load on the spar due to compression component from the lift wire varies as $\frac{G_1}{G_2}$.

If a is the area of the spar then $c_1 a \propto$ end load $c_2 a \propto$ primary bending, $c_3 a \propto$ bending due to end load.

Then $c_1 a \propto \frac{G_1}{G_2}$ and $c_2 a$ is constant.

Since end load bending effect varies both with end load and deflection an approximation may be taken as $c_3 a \propto \left(\frac{G_1}{G_2}\right)^2$, the actual index, however, would really depend on the relative importance of the primary and secondary bending.

Then a and consequently the weight of spar

$$\propto c_2 + c_1 \frac{G_1}{G_2} + c_3 \left(\frac{G_1}{G_2}\right)^2$$

In a typical case for a single bay machine values for

$c_1 = 0{\cdot}37$
$c_2 = 0{\cdot}40$
$c_3 = 0{\cdot}23$ have been found.

Hence in this case

$$W \propto 0{\cdot}40 + 0{\cdot}37 \frac{G_1}{G_2} + 0{\cdot}23 \left(\frac{G_1}{G_2}\right)^2$$

Appropriate values for the constants for multi bay construction can similarly be found, and the values must be appropriate to the structure chosen for the similarity curve.

Supposing the anti-lift wire and bottom spar to be determined by upside down flight conditions, the same expressions will apply.

As example, let us take $\frac{G_1}{G_2} = 0{\cdot}9$.

Then $W \propto 0{\cdot}40 + 0{\cdot}37 \times 0{\cdot}9 + 0{\cdot}23 \times 0{\cdot}81$
$W \propto 0{\cdot}92$

i.e., the weight of the spars in the bay is reduced 8 per cent.

From previous work the weight of the wires, 2 per cent., and the weight of the struts is increased 27 per cent. for constant k.

The weight of the fairing is increased 10 per cent. for constant k.

If the fairing is $\frac{1}{3}$ the weight of the strut, the struts are increased roughly 20 per cent.

For constant l/k the struts and fairings are increased in weight about 13 per cent. The optimum arrangement is probably a mean of these, say, 17·5 per cent.

For the original numerical example (changing from 0·6 to 0·5 span²/W) reasonable values for relative weights of external bracing, struts and spars (less overhang) would be as follows :—

External bracing	7
Struts	10
Spars	20
	37

By the change of gap we have approximately

$7 \times 0{\cdot}98 + 10 \times 117{\cdot}5 + 20 \times 0{\cdot}92$
$6{\cdot}86 + 11{\cdot}75 + 18{\cdot}4 = 37{\cdot}01$

We reach here the remarkable result that the change of gap of 10 per cent. *has made no difference to the weight of the wings*, the increased weight of the struts having just balanced out the reduced weights of the spars and wires.

This case has not been adjusted for the purpose of arriving at this result, but reasonable values have been chosen based on statistical evidence of metal construction. No great significance need attach to the closeness of the two weights, except that it affords evidence that with *reasonable wing arrangements* (*i.e.*, not too unlike the practice of good designers) the influence of change of gap is not very important. The reader may easily extend the methods here used to statistical examples in which he is interested.

By analogy it may be seen that the influence of chord on the primary structure is not very important. Change of chord reduces the drag loads in the spars and the wire loads, but drag struts are increased in weight. The case is actually far more complicated than the lift structure, but the influence of drag loads on spars is only about 20 per cent. of that of the primary loads.

(To be continued.)

TECHNICAL LITERATURE.

AERONAUTICAL RESEARCH COMMITTEE REPORTS.

REPORT ON THE ACCELERATED AGEING OF "Y" ALLOY.

By S. L. ARCHBUTT, F.I.C., AND J. D. GROGAN, B.A.

Work performed for the Engineering Research Board of the Department of Scientific and Industrial Research.

Presented by Dr. W. Rosenhain, F.R.S., Superintendent, Metallurgy Department, National Physical Laboratory.

R. & M. No. 1038 (M.47) (10 pages and 8 diagrams). April, 1926. Price 9*d*. net.

The investigation here described has been carried out to discover, if possible, a method whereby the normal age-hardening period of eight days might be shortened, in order to remove the inconvenience caused in foundry practice by the period of waiting.

The progress of age-hardening has been studied on both chill cast and wrought material by means of tensile and Brinell hardness tests. The effect of temperatures of 150° C. and 100° C. in the air of an electric muffle was first tried. Hardening proceeded rapidly at 100° C., and this temperature was therefore used in subsequent work, boiling water being chosen as the tempering medium.

In the case of the wrought alloy, half an hour at 100° C. is sufficient substantially to complete the age-hardening.

Slight differences only in results have been observed between material which, after quenching, has been tempered (1) immediately, and (2) after a few hours' air-ageing. Material tempered (say, at 100° C.) for a period too short to complete the ageing process, continued to age in air, finally attaining physical properties similar to those of normally air-aged material or of completely-tempered material. Tempering for longer periods up to six hours does not produce any further change in mechanical properties.

With the cast alloy results have been somewhat irregular and further investigation is needed. Excellent results have, however, been obtained from chill cast bars treated at 100° C. for two hours.

WIND-TUNNEL TESTS ON A WING COVERED WITH MONEL METAL GAUZE.

By F. B. BRADFIELD, Maths. and Nat. Sci. Trip.

R. & M. No. 1032 (Ae. 224) (2 pages and 1 diagram). February, 1926. Price 4*d*. net.

In connection with the production of all-metal aeroplanes, the use of monel-metal gauze as a wing covering has been suggested. The gauze might be either undoped or doped. If doped, the aerodynamic properties of a wing covered with gauze or with fabric would differ little, provided the doped fabric was airtight. If a coarse mesh gauze were used, the surface when doped might be rough; but with the fine mesh samples supplied for wind-tunnel test, the surface would be as smooth as doped fabric, and there is no reason to believe that the lift or drag would be in any way affected. Lift, drag and pitching moments have been measured at a wind speed of 60 ft./sec., for a wing of R.A.F. 31 section, 13 in. by 52 in., covered with undoped gauze of 100 mesh, 40½ S.W.G.

The porosity of the undoped gauze makes it entirely unsuitable for a wing covering. The lift rises steadily from $-3 \cdot 5°$ to $27 \cdot 5°$ (the largest angle tested), but at this latter angle k_L is only $0 \cdot 22$. The lift/drag ratio is slightly less than 1 over most of the range.

The lift and drag with the gauze doped have not been measured. On a gauze as fine as 100 mesh it seems probable that the doped surface will be as smooth as doped fabric; but, if the use of a coarse-mesh gauze is contemplated, the doped surface may be rough. In this case further wind-tunnel tests may be required.

NOTE ON A HOT-WIRE SPEED AND DIRECTION METER.

By L. F. G. SIMMONS, B.A., A.R.C.SC., AND A. BAILEY, M.SC., A.M.INST.C.E.

R. & M. No. 1019 (Ae. 220) (7 pages and 17 figs.). February, 1926. Price 9*d*. net.

A form of hot-wire speed and direction meter suitable for use over a large range of wind speed, and possessing a high order of directional sensitivity, is described at some length. Its development is traced from the initial stages of a wire set along the wind to its ultimate form consisting of a grouping of three wires.

Measurements of air flow behind a finite aerofoil made with the three-wire instrument are included for purposes of comparison with corresponding measurements obtained with the standard form of tube instrument.

A special form of hot-wire speed and direction meter has previously been described by one of the writers,* and the present instrument is considered to be a much more satisfactory instrument, and to have met the needs of recent exploration experiments in the N.P.L. wind tunnels.

* R. & M. 777.

TEST OF TWO AEROFOILS, R.A.F.27 AND R.A.F.28.

By A. S. HARTSHORN, B.SC., AND H. DAVIES, B.A.

R. & M. No. 1027 (Ae. 225). (10 pages and 6 figs.). April, 1926. Price 9*d*. net.

A number of wing sections designed in accordance with the theory given in R. & M. 946* have been tested; of these sections, R.A.F. 25 and 26 are thin and R.A.F. 30 to 33 are thick. The two aerofoils tested in the present experiments are intermediate between the thin and the thick sections.

R.A.F. 27 is a symmetrical section of a maximum thickness of 10 per cent. of the chord. R.A.F. 28 is derived from this by curving the centre line with a rise of $0 \cdot 02$ chord, the curvature decreasing to zero at the trailing edge.

Lift and drag have been measured over a speed range from 32 ft./sec. to 120 ft./sec., and the pitching moments at 60 ft./sec.

* R. & M. 946. The theory of the design of aerofoils with an analysis of the experimental results for the aerofoils R.A.F. 25, 26, 30 to 33. By Glauert.

The main characteristics at $VL = 40$ are :—

Aerofoil		k_L max.	k_D min.	k_M at no lift	L/Dmax.
R.A.F. 27	...	0·400	0·0048	0	18·2
R.A.F.28	...	0·492	0·0053	—0·022	22·0

At the higher speeds tested the maximum lift is considerably increased, R.A.F.28 appears to be a suitable wing for biplane construction, and aerodynamically is better than R.A.F.31.

It is proposed to fit R.A.F.28 with a slotted leading edge, and to design a slot and aileron control.

These Reports are published by His Majesty's Stationery Office, London, and may be purchased directly from H.M. Stationery Office at the following addresses: Adastral House, Kingsway, W.C. 2; 28, Abingdon Street, London, S.W.1; York Street, Manchester; 1, St. Andrew's Crescent, Cardiff; or 120, George Street, Edinburgh; or through any bookseller.

AMERICAN NATIONAL ADVISORY COMMITTEE REPORTS.

The National Advisory Committee for Aeronautics in the United States of America corresponds to our own Aeronautical Research Committee. Two distinct classes of reports are issued, the first being known as *Technical Reports*. These Technical Reports are printed, and are illustrated by photographs and/or drawings. The second class are known as *Technical Notes*, and are issued in mimeographed form so as to enable them to be rapidly distributed to a somewhat smaller, but directly interested, circle of readers. Copies of the Reports and Notes may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D.C., U.S.A., but the American N.A.C.A. have a Technical Assistant in Europe, whose office is at 18, Rue Tilsitt, Paris, from whom copies can usually be obtained thus saving a certain amount of time.

The average price of the Technical Reports is 10 cents, which is, of course, remarkably cheap in view of the information contained, and in some instances the price is as low as 5 cents.

THE AERODYNAMIC CHARACTERISTICS OF SEVEN FREQUENTLY USED WING SECTIONS AT FULL REYNOLDS NUMBER.—REPORT No. 233.

By MAX M. MUNK and ELTON W. MILLER, Langley Memorial Aeronautical Laboratory.

This report contains the aerodynamic properties of wing sections U.S.A.5, U.S.A.27, U.S.A.35, U.S.A.35B, Clark Y, R.A.F.15, and Göttingen 387, as determined at various Reynolds Numbers up to an approximately full-scale value in the variable density wind tunnel of the National Advisory Committee for Aeronautics.

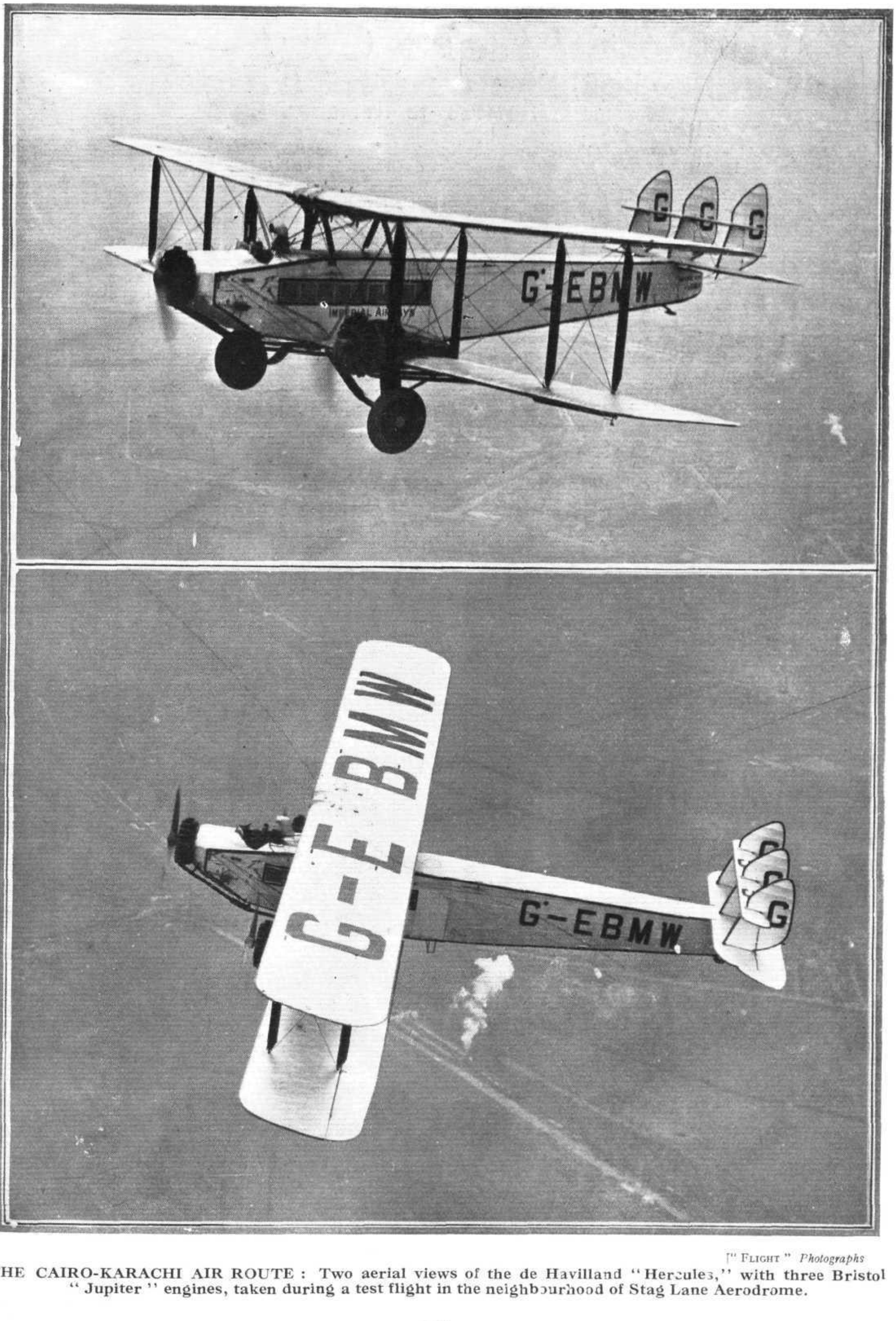
It is shown that the characteristics of the wings investigated are affected greatly and in a somewhat erratic manner by variation of the Reynolds Number. In general, there is a small increase in maximum lift and an appreciable decrease in drag at all lifts.

THREE METHODS OF CALCULATING RANGE AND ENDURANCE OF AIRPLANES.—REPORT No. 234.

By WALTER S. DIEHL, Bureau of Aeronautics, Navy Department.

This report, which was prepared for the National Advisory Committee for Aeronautics, develops new equations which give the range and endurance of airplanes with an accuracy equal to that obtained from a step-by-step integration of the flight. A method of obtaining equally satisfactory results from Breguet's equations is also given in detail. A third method of calculating range and endurance, derived by the writer for use in routine estimating in the Bureau of Aeronautics, is also given in full.

The report contains tables and curves arranged for convenient use, and illustrates the three methods by comparative estimates.



["FLIGHT" Photographs

THE CAIRO-KARACHI AIR ROUTE : Two aerial views of the de Havilland "Hercules," with three Bristol "Jupiter" engines, taken during a test flight in the neighbourhood of Stag Lane Aerodrome.

The Royal Aero Club of the United Kingdom

OFFICIAL NOTICES TO MEMBERS

FEDERATION AERONAUTIQUE INTERNATIONALE

World's Records

AT the Conference of the Federation Aeronautique Internationale held in Rome in October last, the Royal Aero Club was represented by Lieut.-Col. M. O'Gorman, C.B.

It was decided that the carrying of parachutes is compulsory in all attempts for records, with the exception of speed records. A minimum weight of 10 kgs. per parachute must be allowed, and is not included in the "weight of merchandise" carried.

Greatest Load carried to 2,000 m.—The present record is 6,000 kgs. It was decided that additional load should go up in steps of 500 kgs.

These regulations will come into force on April 1, 1927.

Schneider Cup.—The proposal of the Royal Aero Club that the Schneider Cup should be competed for bi-annually instead of annually was adopted.

Subsequent to this decision the race for the Schneider Cup took place in America, and Italy won the Cup. The next race will therefore be held in 1928, in Italy.

Women Pilots.—It was decided that women pilots are eligible for all records. The question of creating a distinct class for women pilots was referred to the January conference, to be held in Paris.

The following questions were also referred to the Paris Conference to be held in January :—

(1) Uniform method of arriving at value of aeroplanes for customs purposes.
(2) Slow-speed requirements for aeroplanes attempting high-speed records.
(3) Classification for light aeroplanes for record purposes.
(4) Instruments for recording temperature in height records.
(5) Automatic timing for high-speed records.

Offices : THE ROYAL AERO CLUB,
3, CLIFFORD STREET, LONDON, W. 1.
H. E. PERRIN, Secretary.

IMPERIAL AIR COMMUNICATIONS

THE report of the Air Communications Special Sub-Committee, of which Sir Samuel Hoare, Secretary of State for Air, was chairman, one of the several committee reports issued in connection with the Imperial Conference, was published on November 22. In our issue for November 4 we gave a report of the discussion on Imperial Air Communications, and this week we give the texts of the report referred to above.

The Sub-Committee heard evidence from various experts of the Air Ministry in London in regard to certain matters discussed, including the technical aspects of airship development and the meteorological organization required for the purpose of experimental flights with a view to the subsequent operation of regular airship services.

The Sub-Committee, having reviewed the present state of air communications in the Empire in the light of the comprehensive information supplied to the Imperial Conference by the Secretary of State for Air, have considered what concrete steps can be taken to further the development of Imperial air services in the immediate future ; and, as a result of their deliberations, submit the following report :—

I. The Sub-Committee are convinced that the development of Imperial air communications, both by airship and aeroplane, is of sufficient importance to merit the early and continuous attention of the Governments of the several parts of the Empire.

II. Accordingly, the Sub-Committee recommend that the Imperial Conference should place on record the following resolutions :—

The Imperial Conference, being impressed with the great benefits, both political and commercial, to be derived from the speeding up of Imperial communications by air—

(1) Takes note with satisfaction—

(*a*) Of the prospective opening of a regular air service between Cairo and Karachi and an experimental service between Khartoum and Kisumu.

(*b*) Of the decisions of His Majesty's Government in Great Britain and in the Union of South Africa to carry out a series of experimental flights to connect so far as possible with this latter service ; and

(*c*) Of the decisiou of His Majesty's Government in Australia to arrange for flights by the Royal Australian Air Force from Australia towards Singapore to link up with similar flights of the Royal Air Force from Singapore towards Australia.

(2) Recommends that the development of other air services should receive the early consideration of the Governments concerned ; and that in this connection particular attention should be paid to the maintenance of existing and the construction of new aeroplanes so far as local resources permit with a view to the ultimate creation of a complete system of Empire air routes.

(3) In view of—

(*a*) The great potentialities of the airship ; and

(*b*) The present lack of constructional and other facilities which must prove a serious obstacle to the early development of regular airship services—

recommends that the Governments of the Dominions concerned and of India should examine the possibility of erecting nucleus mooring mast bases to be available for demonstration flights in 1928-29 by the two airships now under construction, and of instituting such preliminary meteorological investigations as may be necessary to facilitate these demonstration flights ; and that His Majesty's Government in Great Britain should consider the erection of a second shed at the Royal Airship Works at Cardington.

(4) Recommends that an Imperial Air Conference should be held in 1928 or 1929—the precise date to be determined later—at some suitable Imperial centre, to report progress and to consider what further action can be taken for the development of Imperial air communications ; and takes note with appreciation of the invitation of the Dominion of Canada that this Conference should take place in Canada.

III. Finally, the Sub-Committee are of opinion that the present system of communicating information in regard to civil aeronautics should be continued and recommend that, with a view to ensuring still closer co-ordination throughout the Empire, exchanges should be effected from time to time between the Civil Aviation officials of Great Britain and the Dominions and India so far as limitations of staff and local considerations permit.

At the final meeting of the Imperial Conference, on November 22, the following conclusions, regarding Air communications, were reached :—

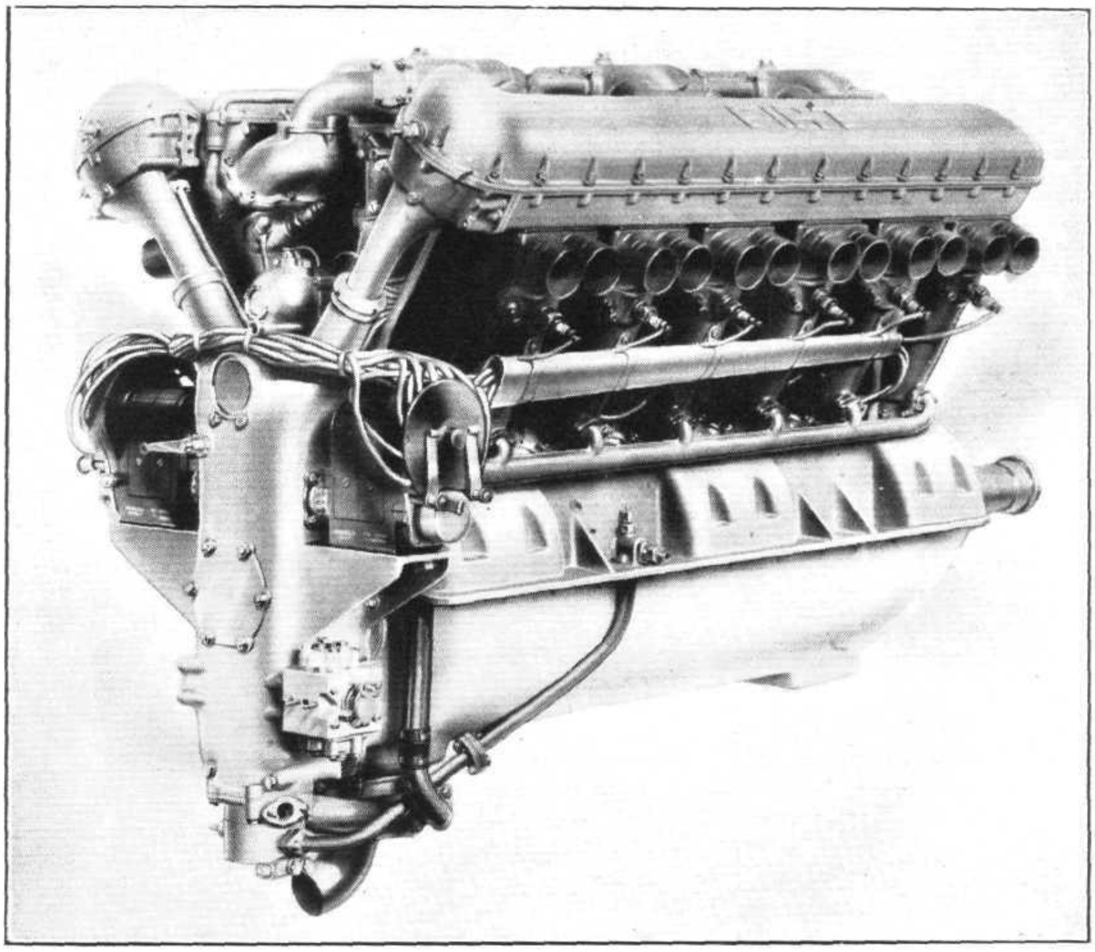
(*a*) The Conference takes note with satisfaction of the substantial progress that has been made since 1923 in building up the Air Forces and resources of the several parts of the Empire.

(*b*) Recognising that the fullest mobility is essential to the effective and economical employment of air power, the Conference recommends, for the consideration of the several Governments, the adoption of the following principle : the necessity for creating and maintaining an adequate chain of air bases and refuelling stations.

(*c*) Impressed with the desirability of still closer co-ordination in this as in all other spheres of common interest, and in particular with the advantages which should follow from a more general dissemination of the experience acquired in the use of this new arm under the widely varying conditions which obtain in different parts of the Empire, the Conference recommends for consideration by the Governments interested the adoption in principle of a system of mutual interchange of individual officers for liaison and other duties, and of complete air units, so far as local requirements and resources permit.

THE 882 H.P. FIAT AERO ENGINE

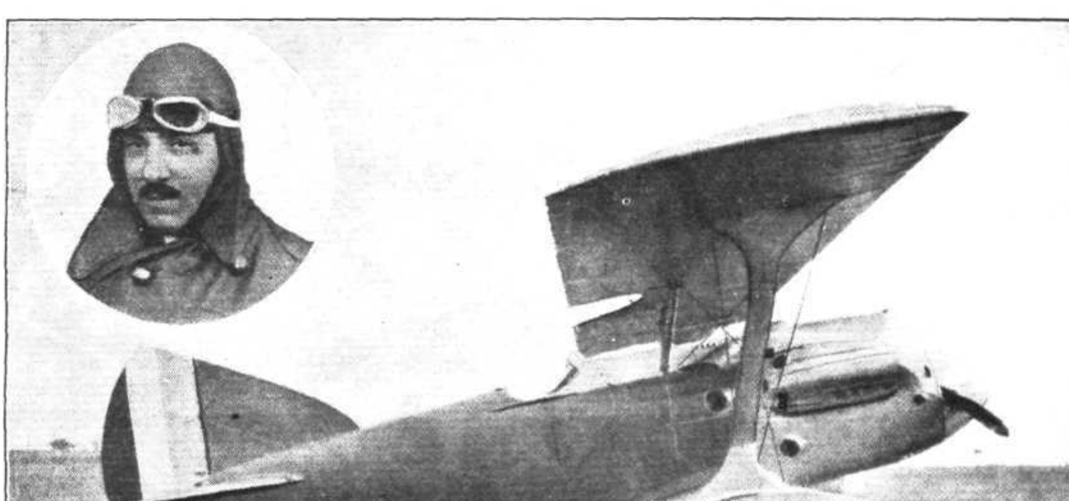
THIS week we are able to publish a photograph of the Fiat engine fitted in the Macchi low-wing monoplane which won the race for the Schneider Trophy at Norfolk, Virginia, at an average speed of 246·496 m.p.h. A photograph of the machine was published in FLIGHT last week.



Winner of the Schneider Cup Seaplane Race: Three-quarter rear view of the 882 h.p. Fiat engine, type A-S.2.

The Fiat engine, it will be seen, is a water-cooled 12-cylinder engine of fairly orthodox design. The angle between the cylinder banks is 60°. The engine, known as the type A-S.2, develops 882 b.h.p. at a speed of 2,500 r.p.m., and the weight of the engine, including oil, water, pump and starter, is 412·1 kgs. (907 lbs.), giving a weight of 1·025 lb./h.p. The bore is 140 mm. and the stroke 170 mm., giving a capacity of 31·4 litres. The compression ratio is stated to be 6 to 1.

The overall length of the Fiat A-S.2 engine is 1·584 m. (62·3 in.), the width 0·720 m. (28·35 in.), and the height 0·948 m. (37·35 in.). This engine will be shown at the Paris Aero Show.



A Record Breaker: The Bleriot-Spad, with 450 h.p. Lorraine-Dietrich engine, on which the French pilot, Jean Callizo, made a world's record altitude flight of 12,442 m. (40,810 ft.) on August 23. This flight, which lasted 2 hrs. 25 mins., thus beat his previous record of 12,066 m. (40,783 ft.) created on October 10, 1924.

FROM THE FOUR WINDS

A New Use for Aircraft

IN an effort to increase the numbers of ducks and muskrats in the northern area of the Province of Manitoba by providing additional sustenance, the Provincial Department of Agriculture has sent north sacks of wild rice to be sown by aeroplane over the vast duck marsh known as Moose Lake and Cedar Lake. This vast marsh, 20 miles wide by 90 miles long, is the largest duck marsh on the Continent, and also constitutes the largest muskrat harbourage.

Cairo-Karachi Air Service

FINAL preparations for the inauguration of the Cairo-Karachi Air Service are being hurried forward, and Maj. Woods Humphrey left England for Egypt yesterday in this connection. The text of the agreement between the Air Council and Imperial Airways regarding this service was issued on November 15, and the provisions therein follow in general those of the agreement of May, 1924, relating to the European services, with, of course, modifications necessitated by the conditions of the new service. Provision is made, for a period of five years, for the establishment of a fortnightly service starting not later than January 1 next. Sir Samuel Hoare and Lady Maud Hoare, it will be remembered, leave Croydon in the first of the three-engined (Bristol "Jupiter") D.H. "Hercules" air liners, which will operate on this route, for Cairo and Karachi, on December 27, to inaugurate the service. The route is divided into two sections: Section I, from Cairo to Basra via Gaza, Ziza, Rutbak, Wells and Baghdad; and Section II, from Basra to Karachi via Bushire, Bandar Abbas, and Chabar. Passengers, mails and goods will be carried, but at first passengers will be carried only over Section I until experience has been gained over the whole route, when the second section will be opened—probably by April—commercially.

A New U.S. Air Transport Service

AN important contract in connection with commercial aviation has just been signed in the United States, between the American Railway Express Co., and the National Air Transport, Inc. The object of the agreement between these two companies is the establishment of air services, for the transportation of express packages, between New York and Chicago, and Chicago and Dallas, with a service to intermediate points on both lines. Mr. Henry Ford is indirectly interested in this scheme, and is represented on the board of Directors of the Air Transport Co. by one of his engineers. The new service is expected to start operations on April 15 next, and the service will be a day and night one, and will carry mail as well as express packages. This is one of the first air services devoted entirely to the transport of express goods, and will probably form the commencement of a network of such lines throughout the States.

Aerial Coastguards

AN aerial coastguard unit has been formed in the United States, comprising five seaplanes, under the command of Lieut.-Comdr. E. S. Stone—the pilot of the NC4 flying-boat which made the Transatlantic flight in 1919—three of which will be stationed at Ten Pound Island, Mass., and two at Cape May, N.J.

Another Flying Club for London

WE are informed that efforts are being made to form an "Independent Private Light Aero Club" in London. The moving spirit of this scheme is Mr. Douglas Usher, who is willing to offer his services as organising secretary and flying instructor in the event of the formation of this club being made possible by the necessary support. It is proposed that there should be an annual subscription of £4, but that there should be obtained, first of all, a register of 100 supporters at a registration fee of 2*s*. 6*d*. (to cover preliminary expenses), who will ultimately agree to become members, at a minimum entrance fee of £1, (payable, together with annual subscription, as soon as full 100 supporters have been registered). It is proposed to purchase a D.H. "Moth" and necessary accessories, and it is suggested that arrangements be made with the De Havilland Aircraft Co., Ltd., regarding maintenance of machine and use of aerodrome. The charges for flying will be as follows:—(*a*) £1 per hour. for flying instruction; (*b*) 15*s*. per hour for solo flying; (*c*) 10*s*. per hour for joy-riding. These charges include cost of instruction, petrol, oil, and damage to machine. If any of our readers may be interested in this scheme, further particulars may be obtained from Mr. Douglas Usher, 268, St. Paul's Road, Canonbury, London, N.1.

Recent World Records for Seaplanes

ON November 17, Major Bernardi, the winner of the Schneider Cup, flying the Macchi M39 monoplane over a 3-km. course at Norfolk, Virginia, averaged a speed of 416·5 km.p.h. (258·8 m.p.h.), thus easily beating Lieut. Doolittle's previous records.

In Germany, two records were recently created, with the help of a British engine, on the Heinkel-Napier seaplane (winner of the Warnemunde competition), when Capt. von Goronau attained an altitude of nearly 12,000 ft. with a load of 2,204·5 lbs., and 18,500 ft. with 1,102 lbs.

Although Great Britain has not yet obtained any world records, she helps to get them, as evident from above, and by the recent seven records obtained at Lake Maggiore, by the Savoia S55 flying boat, which was fitted with "K.L.G." sparking plugs. These records were as follows:—With 500 kgs. (1) (Distance), 950 kms.; With 1,000 kgs. (2) (Duration), 5 hrs. 41 mins. 7 secs.; (3) (Distance), 950 kms.; With 2,000 kgs. (4) (Duration), 5 hrs. 41 mins. 7 secs.; (5) (Distance), 950 kms.; (6) (Speed), 100 kms. at 175·97 k.p.h.; (7) (Speed), 500 kms. at 134·514 k.p.h.

Seville-Buenos Aires Airship Service

IT appears that the Spanish scheme for an airship service between Seville and Buenos Aires, which was first launched in 1920, is to be proceeded with immediately, for the Spanish Council of State has approved the terms of a convention for this service. Col. Herrera, one of the directors of the Colon Compania Transaerea, which will operate the service, stated that they hoped to commence flights in 1927. The first airships would not be built in Spain, but would be hired, and the company had received two offers of rigid airships—one from a British firm and one from a German firm. According to Colonel Herrera, "the British offer is of an airship, at present well advanced in construction, with a cubic capacity of 141,000 cu. m."

French Flight to Madagascar Completed

LIEUT. BERNARD, one of the two French pilots who set out from Marseilles on October 12 for Madagascar, arrived at his destination—Majunga—on November 22. He was flying a Lioré-Olivier flying-boat fitted with a French-built Bristol "Jupiter" engine. His companion, Lieut. Guilbaud, as reported last week, met with a slight mishap on his C.A.M.S. flying-boat at Gaya, on the Niger, and as soon as repairs have been made will proceed as far as Lake Tanganyika, where he hopes to join Lieut. Bernard on his return journey. They will then proceed home together via Lake Victoria and the valley of the Nile. Lieut. Bernard reached Lokoja on November 3, Fort Archambault on November 6, Stanleyville on November 13, Fort Johnston on November 13, and Quilimane on November 19. We hope to give further details of this flight in a subsequent issue of FLIGHT.

The "Moths'" Eastern Tour

CAPT. T. N. STACK and Mr. B. S. Leete, who are flying in two D.H. "Moth" light 'planes towards India, after being held up by bad weather, reached Le Bourget on November 19, and arrived at Lyons on November 21.

The Paris Aero Show and Imperial Airways

DURING the Paris Aero Show, to be held between December 3 and 19, Imperial Airways, Ltd., have decided to issue special rebate tickets to Paris at £8 return, to members of the Air Ministry, the aircraft industry, and serving officers of the Royal Air Force. There is a daily service to Paris which leaves Croydon Aerodrome at 12, arriving at Le Bourget Aerodrome at approximately 2.30 p.m. Cars in connection with this service leave "Airways House," Charles Street, Lower Regent Street, S.W. 1, at 11. Seats must be booked in advance, and application in writing should be made direct to the company at Croydon aerodrome.

Commander Boothby Promoted

COMMANDER F. L. M. BOOTHBY has, as from November 13, been promoted to Captain, R.N., retired. Commander Boothby's name is well known to readers of FLIGHT in connection with airships, and the development of this side of aeronautics owes much to his enthusiastic energies. He was a member of the crew of H.M. Naval Airship No. 1 in 1910, and subsequently he commanded the airship stations at Barrow, Howden, and Pulham. Of late he has done much to further the revival of airships in this country.

Royal Air Force Display, 1927

NEXT year's Royal Air Force Display, the eighth, will take place on July 2, 1927.

DOMINION PREMIERS AT CARDINGTON

Wednesday, November 17, was a drizzly and windy day, and the members of the Imperial Conference who visited the Royal Airship Works, at Cardington, had once again to endure some of the worst rigours of the climate of Great Britain. Three Prime Ministers (Mr. Bruce, of Australia; Mr. Coates, of New Zealand; and Mr. Mackenzie King of Canada), were present in person, and there were also representatives of South Africa, India, and Newfoundland. The weather was not merely uncomfortable; it interfered with the programme. It had been intended to show R. 33 moored to the new mast, and temporary gear to take the old-fashioned "dew-drop" of our one serviceable rigid had been attached to the mast head. But the wind in the morning was so strong that it was not possible to bring the ship out of the shed. This, however, provided a useful object lesson in the value of mooring masts for airships, for once out of the shed, R 33 would have been quite safe at the mast head.

In the afternoon the wind abated somewhat, and Major G. H. Scott took R. 33 up for a flight, intending to drop two Grebes, which were fastened underneath. Squadron-Leader Baker and Flying Officer Mackenzie-Richards went up in the ship, ready to take the Grebes off. But at 700 ft., R. 33 was lost to sight in the clouds, from which she occasionally emerged, looking like a wraith. Though the pilots declare that they can practically fly away from the ship from the very instant of release, still 700 ft. does not give much margin for error, and the Premiers all declaring for "Safety First," the dropping of the aeroplanes was cancelled.

But though the display had thus to be curtailed, the visit was full of interest. The party were able to inspect the new shed, the mooring mast, and the experimental duplicate bay of R. 101, any one of which would have well justified a visit to Cardington. The mast was inspected first. Though it is 201 ft. high, it does not look its height, partly because, standing as it does out on a plain, there is nothing near to give a scale to the eye, and partly because of the width of its base, which has a diameter of 70 ft. It is a steel frame structure, with a lift which holds a dozen people, running up the centre, while round the lift run is a circular staircase. When the party arrived at the foot, the lift was temporarily misbehaving itself, but Mr. Bruce is not a man to be deterred by a little thing like that, and he promptly set out to walk up the stairway, followed by a party of steady-headed stalwarts.

From the lift one disembarks on to a closed-in platform, from which a short stair leads to the embarking platform. This is open, and gives a fine view, with the Chiltern Hills away to the south. The gangway and steps will conform to the motion of the ship as she rides at the mast, but swaying at this point will always be very slight, and it will be no more difficult to enter the gangway than it is to embark on a tube escalator.

Above the embarking platform is the chamber which houses the mechanism of the massive moving arm. Very careful design work has evidently been expended upon this arm, though the actual mechanism appears to be simple and straightforward. The arm itself is a mighty mass of metal weighing 45 tons, and when it is locked solid with the mast, the two will withstand a pull of 30 tons in any direction. When a ship is mooring, the arm will be free to swing through an angle of 30° from the vertical. The operation of mooring commences with one cable being dropped from the nose of the ship and another from the head of the mast. The ends will be coupled on the ground, and then the main winch at the foot of the mast takes in the slack. The ship is manœuvred until its nose is 600 ft. above the masthead, and then two side guys are dropped from the nose of the mast. These are secured to anchor blocks on the ground, of which there are 24, situated in a circle 750 ft. distant from the mast, so as to provide for any direction of wind. These guys are controlled by two more winches at the foot of the mast, but in future masts it will be possible to control both by one winch. All three winches can be operated by remote controls on the embarking platform under the direction of the mooring officer at the masthead. The ship passes through three stages between complete freedom and complete captivity, all provided by the mechanism of the moving arm. When the cone on the nose of the ship has engaged the receiving cup on the arm, the arm is locked in a vertical position, but the receiving cup remains free to rotate horizontally, while the airship cone is carried on a universal joint, and the ship thus has freedom of motion in all directions. The mooring wire is then replaced by a slipping pennant. When about to "sail," the locking pins of the receiving cup are first withdrawn, and the pennant is then slipped.

At the foot of the mast, in addition to the machinery house, there is an underground tank which will hold 10,000 gallons of fuel, with a pump capable of raising 2,000 gallons an hour. There are also two pumps for pumping ballast water up at the rate of 5,000 gallons an hour. A 12-in. gas main also runs up the mast. A similar mast has been erected at Ismailia, and another is about to be erected at Karachi.

From the mast, the party turned to the shed. Again it was difficult to gauge its size by the eye, but when one got inside and saw how small a space inside was taken up by R.33, one began to get some idea of its vastness. At Pulham R.33 looks a right big airship, and one almost forgives the popular papers which habitually describe her as a "mammoth." But at Cardington she looks very small beer. A diagram showed that Bush House could be tucked comfortably away inside this shed. Yet the shed at Karachi is to be even larger. The dimensions are: Cardington—length, 812 ft.; height, 157 ft.; width, 180 ft. Karachi—length, 850 ft.; height, 170 ft.; width, 180 ft.

At one end of the shed the duplicate central bay of R.101 reared itself almost to the roof. R.33, with her cars, could fly right through the centre of this bay. The bay was constructed to afford practice in assembling, and also experiments in resisting static stresses. The bay has been clamped to the end of the shed, all supports removed, and a gas-bag has been inflated inside it. The tests have now been completed, and the bay will be dismantled. Some sections will then be tested to destruction. Not much may be said about the methods of construction, which have departed entirely from Zeppelin practice. Stainless steel is largely used for the girders, as it is lighter, strength for strength, than duralumin, but certain intermediate members are made of the latter metal. Both metals are treated so as to resist corrosion. The stainless steel is sand-blasted and covered with grey lacquer, or else zinc-plated. The duralumin is treated by a process known as the "anodic" process which has been developed at the R.A.E., Farnborough. The diameter of this bay, which is the largest, is 131 ft. 7 in. The overall height of the ship will be about 140 ft., and the length 730 ft.

This first ship does not aim at the ultimate ideal in every direction. Some desiderata have had to be postponed for further research. One such matter is the provision of a substitute for goldbeater's skin in the gas bags. It would not be worth while to hold up the ship pending the result of the research now in progress. High commercial performance has likewise not been placed in the forefront of the programme. That can be dealt with later. But all energies have been concentrated on safety and on the comfort of passengers. The great thing is to prove the principle, to get the airship recognised by the commercial world as a useful and desirable vehicle of travel. The arrangements for the comfort of passengers are quite surprising in their elaboration. The whole of the quarters will be situated inside the hull, at the bottom of the central part of the frame. The control car will project below. Provision is being made for 100 passengers. The quarters will be arranged in two storeys. On the upper deck will be the lounge, the dining-room (to seat 50 at a time), and the main part of the sleeping accommodation. Promenades will run along each side, to give an opportunity for walking exercise, while it will be quite possible to hold dances in the lounge. Wireless, bridge, and perhaps a kinematograph will all help to dispel boredom. On the lower deck will be the smoking-room, the rest of the sleeping cabins, the kitchens, and the crew's quarters. Water will be condensed during flight and shower baths will be provided, the condensation balancing the fuel consumption.

Manufacture of the parts by Messrs. Boulton and Paul, Ltd., will begin at once, and the actual assembling of the airship is expected to take only a few months. It is hoped that she will be ready for trial flights early in 1928, or perhaps a little earlier. Perhaps by then some of the Dominions will have erected standard mooring masts, and, after the trial flights to India both R.100 and R.101 will probably visit such Dominions as possess masts. Once airships have been established in principle their future looks bright. In this connection it is useful to recall the words of Sir Alan Anderson of the Orient line at the Air Conference in 1923. He said "Prove . . . that these ships will do, not all that is asked of them, but half of what is asked of them, that they are reasonably safe and reasonably regular, and I believe you will have any number of people wanting to travel as well as wanting to run them."

F. A. de V. R.

FELIXSTOWE CONSTRUCTORS' DINNER

FROM the enthusiasm displayed at the first Annual Constructors' Dinner, arranged by Wing Commander R. B. Maycock, O.B.E., and the officers, Royal Air Force, Felixstowe, last week, there can be little doubt that the first gathering is not likely to be the last, and that the second and followers are more likely to outgrow the capacity of Felixstowe Messroom. Originality was the order of the day in several directions, although possibly *some* of the ragging during the evening was a repetition and elaboration of past customs and experiences. The Messroom was cleverly arranged in the guise of an old English Tavern, even down to the sawdust "sanded" floor, the menu being in keeping, and the guests found set out round the board a "double-headed" table planned in the form of a dumb-bell, with an ominous array of tankards, besides old English wine glasses, which gave a hint of what was later expected of those partaking of the generous hospitality of the station. There was the roast beef of old England, home-brewed ale, and what not, besides the wines of France and Portugal, and as a finishing touch with the latter, following honour to the King, a batch of real churchwarden pipes and tobacco jars—amply filled—were quietly placed alongside guests and hosts. "Carving hosts" were distributed at intervals round the table, each with his quota of "guests," and so the old-style idea was further exemplified. During the dinner music, appropriate and in keeping (and otherwise) to the idea of the ancient hostelry, discoursed by an entirely voluntary R.A.F. band, tried ineffectually to drown the heartily expressed enjoyment of all those present. But with the entrance with the coffee of the pipers, who circled the dining room several times, even the most stentorious of talkers had to cry a temporary halt. Irrespective of the exhilarating effect, this little interlude more than served its purpose during the evening by giving opportunity for humorous reference to several speakers who voiced their appreciation of this ancient instrument in varying degrees. During the dinner itself an unbroken running fire of hilarious fun was the order of the "day," the spontaneous effect of a camaraderie which was delightful to witness. With the hosts, from the C.O. downwards, there was but one thought, the enjoyment of their guests. Possibly the only inhospitable action was the insistence upon the poor press representatives taking their turn in a round robin of 5-minute speeches.

C.O. Wing Commander R. B. Maycock opened the after-dinner proceedings by giving a hearty welcome for the first time in their own "Home" to all their old friends. It was the first occasion, he said, the unit had launched out in a gathering of this sort—possibly because at Felixstowe they had hitherto felt a little out of the limelight, but now, through the advent of the seaplane, they had come right into the picture, which he thought would justify this departure.

THE FELIXSTOWE CONSTRUCTORS' DINNER: The Menu Card

Mr. Cowlin, in supporting the C.O. in the toast of "The Guests," said he hoped the precedent set by that meeting might be continued annually for years and years, the toast being received with musical honours.

Mr. Fairey, in opening the responses, expressed on behalf of the guests their appreciation and gratitude for all that Felixstowe Air Station was doing for aviation in general and the constructors. The constructors were a very much misunderstood class. As a fact, they were all working for the benefit of aviation and its future without a tinge of jealousy between each other. After the war they had all had a disastrous and strenuous time to keep going at all, but most of those who were real constructors had by one means or another managed to exist by taking on temporarily any odd job that might fill the gap for keeping their works going until better times and appreciation of aviation came along—which reminded him of an inquiry as to what one firm was filling up with, and when told they were making coffins, the further query was "what engine are they putting in?"

Mr. Handley Page humorously filled up his five minutes, and seriously considered that aviation had now entered into the ordinary uses of life.

Following Mr. Oswald Short, Commander Bird proposed the toast of "The President and Officers of R.A.F., Felixstowe Station," which was, needless to say, musically honoured, and amongst others who more or less respected their respective 5 minutes' speech limit were Major Buchanan, Mr. Parnall, Mr. Robert Blackburn, Mr. Nicholson, Mr. Folland, Mr. J. Lord, Mr. Winter and Mr. Frank Courtney.

An adjournment was then made to the anterooms, where further pleasantries were indulged in, whilst, appropriate to the old-time atmosphere of the evening, steaming bowls of punch appeared upon the scene about midnight.

Altogether, Mr. President, Vice-President and gentlemen, a grand evening.

Guests and hosts present included Sqdn.-Ldr. Woodhouse, Sqdn.-Ldr. M. Wright, Sqdn.-Ldr. Rea, Sqdn.-Ldr. Slatter, Flight-Lieuts. Sawyer, Gray, Staton, Massey, Wilkinson, Comper, Chick, Hunter, Hackney, Hatcher, Brook, Courtney, Cross, Flying Officers Stocken, Wardle, Usher, Stafford, Goadsby, Clemens, Dipple, Martin, Ballantyne, Worsley, Soper, Horwood, P. O. Amy.

Commander J. Bird, Major J. S. Buchanan, Major Bumpus, Capt. Norman McMillan, Capt. C. E. Nightingale, Capt. Bennett Baggs, Capt. C. W. Lamb, Messrs. A. J. A. Wallace Barr, H. Biard, R. Blackburn, H. Bolas, L. P. Coombes, F. E. Cowlin, C. R. Fairey, H. P. Folland, C. G. Grey, W. L. Jackson, W. Lanachberry, W. Lappin, John Lord, R. J. Mitchell, W. Nickolson, C. E. R. Osman, F. Handley Page, W. L. Parker, George Parnall, J. D. Rennie, Oswald Short, Stanley Spooner, G. G. H. Winter.

No. 3 Squadron, R.F.C., and No. 3 (Fighter) Squadron, R.A.F., Annual Reunion Dinner

THE third reunion dinner of the above will be held at the Trocadero on Wednesday, December 1 next, at 7.45 p.m. for 8 p.m. Air Marshal Sir J. M. Salmond, K.C.B., C.M.G., C.V.O., D.S.O., A.D.C., in the chair. Tickets 12*s.* 6*d.*, obtainable at the dinner.

Royal Air Force Flying Accident

THE Air Ministry regrets to announce that as the result of an accident at Kenley, Surrey, to a D.H.9A., of No. 24 Squadron, Kenley, on November 22, Flight-Lieut. Felix St. John Woollard, A.F.C., the pilot of the aircraft, was killed, and Flying Officer Frederic Laing Collison was seriously injured and died shortly afterwards.

THE ROYAL AIR FORCE

London Gazette, November 19, 1926.

General Duties Branch

The follg. are granted permanent commissions in the ranks stated (Nov. 1)—FLIGHT LT.—F. H. Shales. FLYING OFFICER.—H. N. Thornton.

Pilot Officer J. H. Barringer is promoted to rank of Flying Officer (Oct. 14).

The follg. Flying Officers are transferred to the Reserve :—CLASS A.—W. G. Nicholls (Nov. 18) ; CLASS C.—N. H. F. Unwin (Nov. 13).

Flying Officer S. T. Littleton resigns his permanent commission (Nov. 17). The follg. resign their short service commissions (Nov. 17) :—Pilot Officer J. T. C. Skellon, Pilot Officer on probation L. S. S. Tunks. The short service commn. of Pilot Officer on probation A. E. Scott Moore is terminated on cessation of duty (Nov. 17) ; G. H. Morris, Lt., R.M., Flying Officer, R.A.F., relinquishes his temp. commn. on return to duty with Royal Marines (Nov. 10) ; Flying Officer R. L. Yates (Lt., Royal Scots Fus.) relinquishes his temp. commn. on return to Army duty (Oct. 26).

Stores Branch

Flying Officer on probation O. G. Ridley, M.C. (Maj., R.A.R.O.), is confirmed in rank (Oct. 6).

Accountant Branch

Flying Officer B. E. Hume Wright is transferred to Reserve, Class C (Nov. 15).

Medical Branch

Flying Officer W. A. Beck, M.B., D.P.H., is transferred to the Reserve, Class D.2 (Nov. 19).

Memorandum

R. W. Stevens is granted a temp. commn. as a Flight Lt. (Legal Officer) (Nov. 11).

Reserve of Air Force Officers

The following Pilot Officers are promoted to rank of Flying Officer :—R. N. Bullock (June 17) ; A. R. J. Savage (Sept. 24) ; John Gallacher (Oct. 3). Pilot Officer on probation F. R. Matthews is confirmed in rank (Nov. 9). The following Flying Officers are transferred from Class A to Class C :—H. MacMillan (Nov. 12) ; A. D. Drysdale (Nov. 13). Flying Officer F. R. Steggall, D.C.M., relinquishes his commission on completion of service (Oct. 24).

AUXILIARY AIR FORCE

General Duties Branch

The following to be Pilot Officer :—No. 600 CITY OF LONDON (BOMBING) SQUADRON.—G. de H. Vaizey (Nov. 16).

ROYAL AIR FORCE INTELLIGENCE

Appointments.—The following appointments in the Royal Air Force are notified :—

General Duties Branch

Squadron Leader K. C. Buss, to H.Q., Irak, 12.11.26.

Flying Officers: W. E. Purdin, to No. 1 Flying Training School, Netheravon ; 22.11.26. F. L. Collison, to No. 39 Sqdn., Spittlegate ; 17.11.26.

Medical Branch

Flight Lieutenants: C. P. Barber, to Basrah Combined Hospital, Iraq ; 18.10.26. T. V. O'Brien, M.B., to Station Commandant, Hinaidi ; 16.10.26. G. P. O'Connell, M.B., to H.Q., India ; 17.10.26.

Flying Officers: G. J. Griffiths, to Basrah Combined Hospital, Iraq, 14.10.26. D. B. Smith, M.B., and F. B. C. L. B. Crawford,'M.B., to R.A.F., British Hospital, Iraq ; 16.10.26. J. McM. Wilder and R. J. K. Chattey, to Station Commandant, Hinaidi ; 16.10.26. B. L. Edwards, M.B. and E. A. Aslett, to Station Commandant, Basrah ; 14.10.26.

NAVAL APPOINTMENTS

The following appointments have been made by the Admiralty :—

Lieuts. (Flying Officers, R.A.F.).—A. Brock and G. R. F. T. Cooper, to *Furious*, and for full flying duties in 420 flight (Sept. 18 and Oct. 18 respectively).

Promotion

Commander (retd.) F. L. M. Boothby, C.B.E., to rank of Capt. (rtd.) (seny. Nov. 13).

IN PARLIAMENT

Civil Aviation Subsidies

SIR H. BRITTAIN, on November 15, asked the Secretary of State for Air the annual amounts of subsidy for civil flying granted by Great Britain, France and Germany respectively ; and whether every effort is being made by His Majesty's Government to give at least similar support to the development of our civil air service as is the case in the other two countries referred to ?

Sir Samuel Hoare : As regards the first part of the question, the total sum allocated to the development of civil aviation in Air Votes for the current year is £462,000. In addition, £362,000 is being expended on airship development, which is, to a large extent, for civil aviation purposes. It is difficult to give exactly comparable figures in respect of France and Germany, but the following are approximate : France, 78,175,000 francs ; Germany, 24,661,500 Reichmarks.

Actual subsidy payments to civil air transport companies are as follow : Great Britain, £167,000 ; France, 59,500,000 francs ; Germany, 8,371,500 Reichmarks.

As regards the second part of the question, the policy of His Majesty's Government is to spare no effort to place the operation of civil air transport on a commercial footing as early as possible.

Captain P. Macdonald : Is it not a fact that the large subsidy paid by the German Government for civil aviation enables Germany to control and operate 75 per cent. of the civil air lines in Europe ?

Sir S. Hoare : I do not think that arises out of the question. I should like to have notice of the question. I do not know whether the percentage given is accurate or not.

Karachi Airship Base

MR. SCURR asked the Under-Secretary of State for India what progress has been made with the work on the airship base at Karachi ; and when it is expected that the work on this airship base will be finished ?

The Under-Secretary of State for Air (Sir Philip Sassoon) : I have been asked to reply. In answer to the first part of the question, considerable progress has been made with the work. The site has been cleared, the foundations of the shed have been laid and part of the steel work erected, and many of the ancillary works services have been completed. As regards the second part of the question, all the work now in hand should be completed in the latter part of 1927.

Bagdad Aeroplane Accident

COLONEL DAY, on November 19, asked the Secretary of State for Air if he is yet in a position to state the result of the inquiry into the disaster to the biplane troop-carrier at Bagdad on July 26 last, which resulted in the death of seven airmen ?

SIR S. HOARE : Inquiry has shown that the cause of the accident was the breaking of the starboard engine crankshaft just after the aeroplane had taken off and was at a height of 100 ft. above the aerodrome. The reason why the pilot did not throttle back the port engine, which would have enabled the aeroplane to glide straight on, was apparently that he hoped to be able to reach some open ground on the right and to avoid obstructions immediately in his front.

Royal Air Force Accidents

COLONEL GRETTON, on November 22, asked the Secretary of State for Air how many fatal accidents there have been in the Air Force this year and how many lives have been lost ; what were the corresponding losses last year ; the numbers of machines destroyed by accidents this year and last year ; can he attribute the crashes of flying machines and loss of life in the Air Service to any general cause ; and what steps he is taking to reduce the number of accidents ?

Sir S. Hoare : The figures requested in the first three parts of the question for the period January 1 to November 18, 1926, and for the corresponding period in 1925, are as follows :—

	1926.	1925.
Fatal accidents	49	36
Deaths	78	50
Aircraft reported by November 18 as written off charge as a result of crashes	230	212

Of the deaths in 1926, 15 have occurred in three accidents, two of which may be regarded as of an exceptional character. I should add that the amount of flying in 1926 to date is materially in excess of that for the corresponding period of 1925. The figures relate to Royal Air Force personnel only, and do not include aircraft written off charge as a result of enemy action. As regards the fourth part, in spite of continuous and careful scrutiny of every individual accident, no general cause can be assigned. Many accidents are the result of a combination of causes. A mechanical failure, containing no element of danger itself, but necessitating a forced landing, may be followed by a crash due to bad ground, or an error of judgment. A slight error of judgment in the air, especially near the ground, may have fatal results, whereas a similar error of judgment on the ground, as when driving a motor-car, probably results only in minor material damage. As regards the last part, the steps which are being taken are continuous. All sides of this question are carefully watched, *e.g.*, the number of accidents, the stations at which they occur, the time of the year, the nature of the country, the type of machine, the medical and flying history of the pilot, methods of training, etc., etc. Every serious accident is investigated by an independent inspector reporting to the Secretary of State, as well as by a local court of inquiry. Endeavours are also being made to evolve more controllable machines, and mechanical devices designed to increase the safety of flying. Parachutes have been generally introduced and have saved several lives this year. It must also be remembered that aircraft are constantly and necessarily improving in performance, and every addition to speed and power tends to make the result of an accident more serious. My right hon. and gallant friend may rest assured that this question is engaging my constant personal attention, and that every possible precaution is and will continue to be taken with a view to safeguarding the lives of our flying personnel by all means in our power.

An Imperial Airways Change

WILL readers please note that from November 27 the London office of the Imperial Airways, Ltd., will be removed from Wolseley House, Piccadilly, to Airways House, Charles Street, Lower Regent Street, S.W.1 (Telephone, Regent 7861—7865). The Piccadilly office will be closed after this date, and, beginning on Wednesday, December 1, the departure station for passengers will be Airways House, and *not* Hotel Victoria, as hitherto. On the inwards journey, the cars conveying passengers from Croydon Aerodrome to Airways House will, when required, also call at Hotel Victoria.

Air Bombs in Brazil

A REVOLUTION broke out last week in the Brazilian State of Rio Grande do Sul, and the town of Santa Maria was bombed by revolutionary aeroplanes, a large hotel and a bank being destroyed.

PERSONALS

Married

On October 23, at the Cathedral, Bombay, Flight-Lieut. CHRISTOPHER N. H. BILNEY, R.A.F., second son of Mr. and Mrs. Bilney, Newbury, Berks, was married to NELLIE G. PERREN, elder daughter of the late Mr. T. Perren and Mrs. Perren, Box, Wilts.

Flight-Lieut. HERBERT BAINBRIGGE RUSSELL, A.F.C., only surviving son of the late Herbert Russell and Mrs. Russell, of 24, Argyll Mansions, was married on October 30, at St. Garmon's Church, Capel Garmon, to MARGARET ANN, youngest daughter of Mr. and Mrs. GEORGE BOVILL, of Rhydycreua, Bettws-y-Coed.

FLIGHT-LIEUT. C. G. WIGGLESWORTH, A.F.C., second son of George Wigglesworth, of Brighton, was married on October 23, at Holy Trinity, Brompton Road, to MARGARET CADE, younger daughter of the late Arthur Cade and Mrs. Bemrose, of 26, Oakwood Court, Kensington.

To be Married

The engagement is announced between FRANCIS F. INGLIS, R.A.F., eldest surviving son of the late Mr. Alfred Inglis and of Mrs. Alfred Inglis, of the Hollies, Bickley, and VERA, second daughter of Mr. and Mrs. CECIL W. TURNER, of 49, Cleveland Square, W.2.

An engagement is announced between Capt WALTER HENRY PARK, M.C., D.F.C., R.A.F., second son of the Rev. James Park, of Park Still, Broughton-in-Furness, and Miss EDITH MARY HIRST, younger daughter of Mr. and Mrs. Hirst, of Rylstone, Broughton-in-Furness.

A marriage has been arranged, and will take place quietly in London, between DONALD SALISBURY GREEN, R.A.F., eldest son of Mr. and Mrs. Owen Green, of Harpenden, and NANCY WHITER, daughter of Mr. and Mrs. MACALISTER, of Worthing and St. Albans.

SOCIETY OF MODEL AERONAUTICAL ENGINEERS (S.M.A.E.)

THE Society's flying programme for this year having now come to an end, a list of the standing records to date is given below. It is of interest to note that during the season no less than four records have been raised and two new ones established (the former are marked "r" and the latter "n" in the list).

British Model Aeroplane Records (November, 1926).

Model.	Type Formula of Model.	Holder of Record.	Duration in Seconds.	
Fuselage Models.				
Fuselage Glider (H.L.) ..	O–I–I	R. N. Bullock	$51\frac{1}{5}$	*r*
Fuselage Flying Model (R.O.G.) (Rubber Driven)	P–O–I–I	W. J. Plater	$45\frac{3}{5}$	*r*
Fuselage Flying Model (H.L.) (Rubber Driven)	P–O–I–I	W. J. Plater	50	*r*
Fuselage Flying Model (R.O.G.) (Compressed Air Driven)	P–O–I–I	D. A. Pavely	43	
Spar Models.				
Twin Pusher (R.O.G.) ..	$I–I–O–P_2$	S. C. Hersom	247	
Spar Tractor (H.L.) ..	P–O–I–I	R. N. Bullock	108	*r*
Farman Type (R.O.G.) ..	O–I–P–I	C. A. Rippon	$32\frac{2}{5}$	
Farman Type (H.L.) ..	O–I–P–I	C. A. Rippon	$37\frac{4}{5}$	
Spar Glider (H.L.)	O–I–I	C. J. Burchell	$53\frac{2}{5}$	
Seaplanes.				
Spar Tractor (R.O.W.) ..	P–O–I–I	S. C. Hersom	43	
Twin Pusher (R.O.W.) ..	$I–I–O–P_2$	S. C. Hersom	65	
Fuselage Tractor (R.O.W.)	P–O–I–I	S. C. Hersom	10	*n*
Other Types.				
Compressed Air (Non-fuselage) (R.O.G.)	P–O–I–I	D. A. Pavely	70	
Petrol Driven (R.O.G.) ..	P–O–I–I	D. Stanger ..	51	
Autogiro (H.L.)	$O–I–I–P_2$	D. A. Pavely	22	*n*

H.L. signifies hand-launched.
R.O.G. „ rising off ground.
R.O.W. „ rising off water.

Two well-attended meetings took place at Headquarters on October 22, and November 5. On Friday, November 19, at 7.30 p.m., Mr. D. A. Pavely read a paper on "Compressed Air Plants."

B. K. JOHNSON, *Hon. Secretary*

IMPORTS AND EXPORTS, 1925-1926

AEROPLANES, airships, balloons and parts thereof (not shown separately before 1910). For 1910 and 1911 figures see "FLIGHT" for January 25, 1912; for 1912 and 1913. see "FLIGHT" for January 17, 1914; for 1914, see "FLIGHT" for January 15, 1915; for 1915, see "FLIGHT" for January 13, 1916; for 1916, see "FLIGHT" for January 11, 1917; for 1917, see "FLIGHT" for January 24, 1918; for 1918, see "FLIGHT" for January 16, 1919; for 1919, see "FLIGHT" for January 22, 1920; for 1920, see "FLIGHT" for January 13, 1921; for 1921, see "FLIGHT" for January 19, 1922; for 1922 see "FLIGHT" for January 18, 1923; for 1923, see "FLIGHT" for January 17, 1924; for 1924, see "FLIGHT" for January 22, 1925; for 1925, see "FLIGHT" for January 21, 1926.

	Imports.		Exports.		Re-Exports.	
	1925.	1926.	1925.	1926.	1925.	1926.
	£	£	£	£	£	£
Jan. ..	3,546	494	83,728	130,049	291	—
Feb. ..	985	2,089	85,639	40,416	20	6,341
Mar. ..	—	1,001	56,881	92,840	9,355	9,758
Apl. ..	321	536	78,041	160,832	6,732	5,051
May ..	560	342	74,844	118,539	15,278	—
June ..	190	24,866	71,009	6[illegible],111	667	150
July ..	184	16,033	159,262	39,047	870	—
Aug. ..	469	21,401	113,054	146,129	—	1,035
Sept. ..	1,224	3,172	111,237	55,674	213	—
Oct. ..	460	528	114,563	41,968	855	30
	7,939	70,462	948,258	891,605	34,281	22,365

PUBLICATIONS RECEIVED

Airworthiness Handbook for Civil Aircraft. Air Publication 1208, 1926. H.M. Stationery Office, Kingsway, London, W.C.2. Price 1*s.* 3*d.* net.

The Air Pilot Monthly Supplement. No. 25. *November*, 1926. Air Ministry, Kingsway, London, W.C.2.

Catalogue

Morris Slings. Herbert Morris, Ltd., Loughborough.

AERONAUTICAL PATENT SPECIFICATIONS

(*Abbreviations*: Cyl. = cylinder; i.c. = internal combustion; m. = motor. The numbers in brackets are those under which the Specifications will be printed and abridged, etc.)

APPLIED FOR IN 1925
Published November 25, 1926

16,300. C. M. HALL. Light metallic constructions for aircraft, etc. (260,316.)
25,921. SUPERMARINE AVIATION WORKS, LTD., and R. J. MITCHELL. Aircraft. (260,413.)

APPLIED FOR IN 1926
Published November 25, 1926

4,173. H. E. S. HOLT. Parachute containers. (260,471.)
7,385. ARMSTRONG SIDDELEY MOTORS, LTD., and S. M. VIALE. Attachment of cylinders to crank-cases. (260,480.)

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